RETURN TO THIS MANUAL'S TABLE OF CONTENTS
RETURN TO CD-ROM TABLE OF CONTENTS

DrägerService®

Dräger

Technical Service Manual

Part Number: S002013
Rev: V
Date: 20 May 2002
© 2002 Draeger Medical, Inc.

Narkomed 3
Anesthesia System

RETURN TO THIS MANUAL'S TABLE OF CONTENTS
RETURN TO CD-ROM TABLE OF CONTENTS

DrägerService®

Narkomed 3 Service Manual Table of Contents

Summary of What's New in Rev. B

DESCRIPTION **PAGE**

SECTION 1:
Introduction 1-1

SECTION 2:
Diagnostics 2-1
2.1 Service Selection Screen 2-2
2.2 Configuration Screen 2-3
2.3 Service Data Screen 2-4

SECTION 3:
Troubleshooting 3-1
3.1 Power Supply and Voltage Distribution 3-1
3.2 Multispec Analyzer Power Supply 3-4
3.3 Troubleshooting Guide Flow Charts 3-5

SECTION 4:
Replacement Procedures 4-1
4.1 Cylinder Yoke Assemblies 4-2
4.2 Cylinder Pressure Regulators 4-5
4.3 Cylinder Cutoff Valves (Canada) 4-9
4.4 Cylinder and Pipeline Pressure Gauges 4-12
4.5 Flowmeters 4-16
4.6 Flow Control Valves 4-20
4.7 Oxygen Supply Pressure Failure Protection Device 4-23
4.8 Oxygen Supply Pressure Alarm Switch 4-26
4.9 Oxygen Supply Pressure Alarm Whistle (Canada) 4-29
4.10 Oxygen Ratio Monitor/Controller 4-31
4.11 Vaporizers 4-37
4.12 O_2 Flush Valve 4-40
4.13 Ventilator Controller Assembly 4-44
4.14 Ventilator Solenoid Valve 4-47
4.15 Convenience Outlet AC Power Filter 4-50
4.16 Inspiratory Flow Regulator 4-53
4.17 Ventilator Bellows Valve and Guide Assembly 4-56
4.18 Alarm Channel 4-66
4.19 Multispec Analyzer 4-69
4.20 ECC (Serial Interface) Module 4-77
4.21 Sphygmomed Module 4-79
4.22 Monitors (Typical) 4-82
4.23 Trend Assembly 4-85
4.24 CCC (Central Communications Controller) Assembly 4-88

DESCRIPTION **PAGE**

4.25 CRT Asemblies 4-91
4.26 Keypads 4-94
4.27 Pulse Oximeter Module 4-97
4.28 Power Controller Assembly 4-99
4.29 Multispec Power Supply 4-101
4.30 Primary Power Supply 4-103
4.31 Battery Pack 4-105
4.32 Caster 4-107
4.33 Spiromed Respiratory Volume Sensor 4-110
4.34 Oxygen Sensor 4-112
4.35 Manual Sphygmomanometer 4-114
4.36 Auxiliary Oxygen Flowmeter 4-116
4.37 PEEP Valve Magnet Assembly Replacement 4-118

SECTION 5:
Adjustment and Calibration Procedures 5-1
5.1 Cylinder Pressure Regulator Adjustment (except CO_2) 5-2
5.1A CO_2 Cylinder Pressure Regulator Adjustment 5-4
5.2 Oxygen Supply Pressure Alarm Switch Adjustment 5-5
5.3 Oxygen Ratio Monitor/Controller Adjustment 5-8
5.4 Oxygen Monitor Calibration 5-12
5.5 Baromed Monitor Calibration 5-15
5.6 Multispec Analyzer Calibration and Flowrate Adjustment 5-17
5.6A Multispec 4610 Analyzer Calibration and Flowrate Adjustment 5-23A
5.7 CRT Alignment 5-24
5.8 Vaporizer Interlock Adjustment 5-27
5.9 Vaporizer Select Switch Adjustment 5-29
5.10 Capnomed (B) Barometric Pressure Adjustment for High Altitudes . . . 5-31
5.11 Capnomed Span Calibration 5-34

SECTION 6:
PMS Procedure 6-1
6.1 Manual Sphygmomanometer 6-2
6.2 Yoke Assemblies and Gauges 6-3
6.3 High Pressure Leak Test 6-5
6.4 Oxygen Supply Pressure Alarm 6-8
6.5 Oxygen Supply Failure Protection 6-9
6.6 O_2Med Offset Calibration 6-12
6.7 O_2Med Calibration, Accuracy and Alarms Test 6-12
6.8 Oxygen Concentration Test 6-14
6.9 Flowmeter Test 6-16
6.10 Freshgas Leak Test 6-19
6.11 Repack MAN/AUTO Selector Valve 6-20
6.12 Absorber System Inspection 6-21
6.13 Lubrication, Spiromed Sensor 6-22
6.14 Breathing System Leak Test 6-23
6.15 Absorber Flow Direction and Leak Test 6-23
6.16 APL Valve Test 6-25

DESCRIPTION **PAGE**

6.17 PEEP Bypass Valve 6-25
6.18 Ventilator Test 6-26
6.19 Ventilator Relief Valve Test 6-29
6.20 Bellows Drive Gas Leak Test 6-29
6.21 Bellows PEEP Valve Test 6-30
6.22 Pressure Limit Control Test 6-30
6.23 Trace Functions 6-31
6.24 Trend Functions 6-32
6.25 Spiromed Monitor 6-33
6.26 Alarm Circuit Delay Test 6-35
6.27 BAROMED Monitor Calibration 6-36
6.28 Continuing Pressure Alarm 6-37
6.29 High Pressure Alarm 6-37
6.30 Sub-Atmospheric Pressure Alarm 6-37
6.31 Oxygen Ratio Monitor Control Test 6-38
6.32 Scavenger Interface 6-40
6.33 Scavenger, A/C 6-43
6.34 Open Reservoir Scavenger 6-45
6.35 Sphygmomed 6-47
6.36 Nellcor O_2SatMed 6-48
6.36A Novametrix O_2SatMed 6-49A
6.37 Capnomed CO_2 Monitor 6-50
6.38 Vapor Exclusion System and Indicator Lamps 6-53
6.39 Multispec Accuracy Test 6-54
6.40 Accessory Attachments and Visual Inspection 6-58
6.41 Battery Circuit Test 6-58
6.42 Ground Continuity Test 6-59
6.43 Chassis Leakage Current Test 6-60
6.44 Service Data 6-60
6.45 Oxygen Flush Test 6-61
6.46 Operator's Manual 6-62
6.47 Final Check 6-62

SECTION 7:
Software Update Procedure 7-1
7.1 Monitors Firmware Replacement (Typical) 7-2
7.2 CCC Assembly Firmware Replacement 7-4
7.3 Trend Assembly Firmware Replacement 7-6
7.4 ECC (Serial Interface) Module Firmware Replacement 7-8
7.5 CRT Assembly (Typical) Firmware Replacement 7-10
7.6 Gas Analyzer Interface PCB (4610) Firmware Replacement 7-12

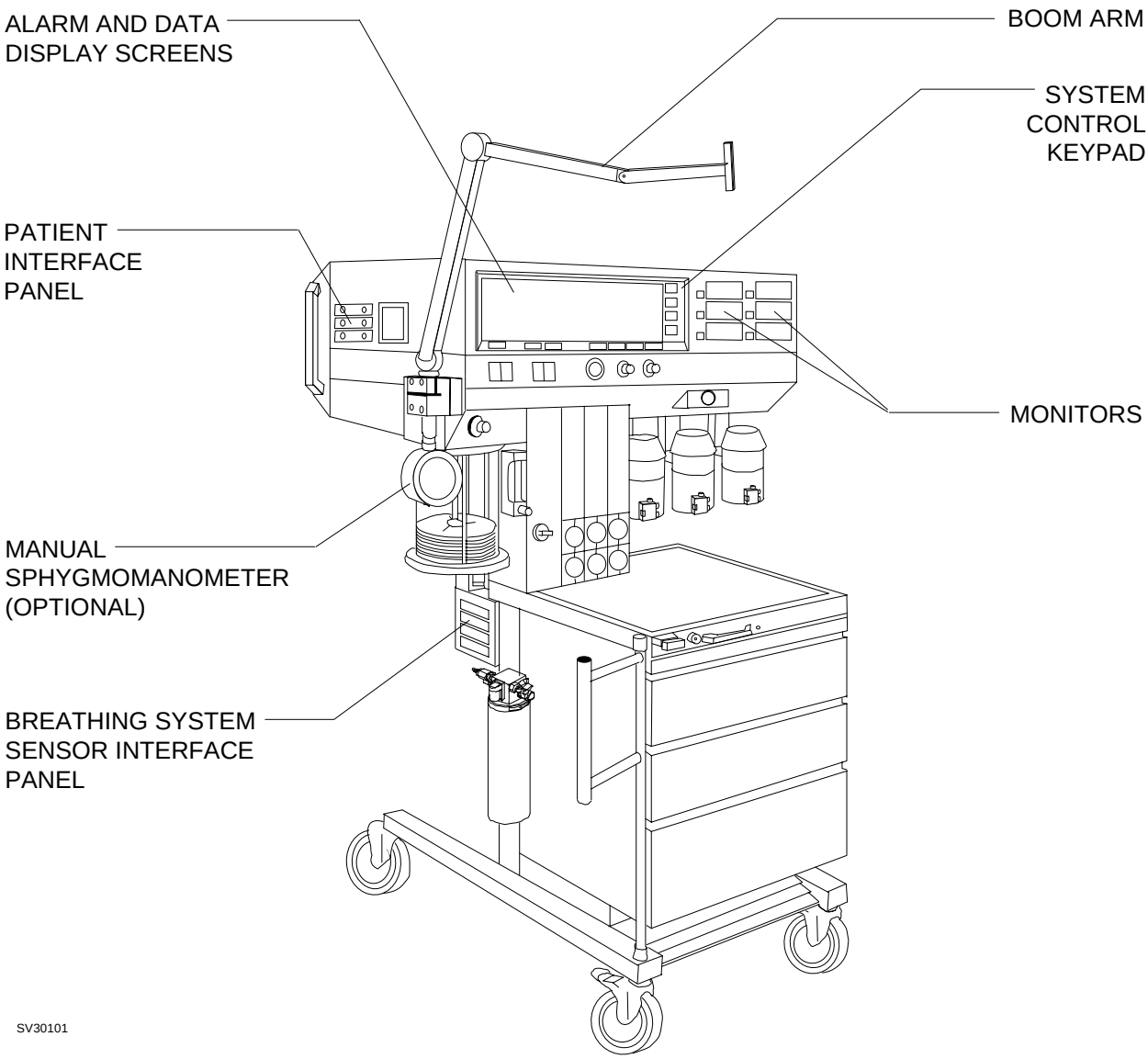
SECTION 8:
Spare and Replacement Parts

ASSEMBLY/PART PAGE

Monitor Chassis, Monitors, CCC, Trend/MUX, CRT Assemblies 8-2, 8-3
Front Bezel Assembly, Serial Interface Assembly 8-4, 8-5
Multispec Analyzer Assembly, incl. PCB Assembly 8-6, 8-7
Sphygmomed Module, Pulse Oximeter Module 8-8, 8-9
Ventilator Box Assembly 8-10, 8-11
Ventilator Bellows Valve & Guide Assembly 8-12, 8-13
Pipeline Inlet, Failsafe, Alarm Channel Assemblies 8-14, 8-15
ORMC, Vaporizer Select Switches 8-16, 8-17
Flow Tubes, Gauges, Flow Control Valves, Alarm Channel Items 8-18, 8-19
Yoke, Regulator, Flush Valve Assemblies 8-20, 8-21
Interface Panels, Power Supply Assemblies, Casters 8-22, 8-23
Absorber Assembly, Breathing Pressure Hoses, Oxygen Sensor 8-24, 8-25
Man/Auto Selector Valve 8-26, 8-27
Man/Auto Selector Valve (Later Design) 8-28, 8-29
Auxiliary O_2 Flowmeter Assembly 8-30, 8-31
Open Reservoir Scavenger 8-32, 8-33
Open Reservoir Scavenger, old style 8-34, 8-35
A/C Scavenger 8-36, 8-37
Suction Scavenger 8-38, 8-39

RETURN TO THIS MANUAL'S TABLE OF CONTENTS
RETURN TO CD-ROM TABLE OF CONTENTS

NARKOMED 3 ANESTHESIA SYSTEM



1.0 Recommendations

Because of the sophisticated nature of Draeger Medical, Inc. anesthesia equipment and its critical importance in the operating room setting, it is highly recommended that only appropriately trained and experienced professionals be permitted to service and maintain this equipment. Please contact DrägerService® at (800) 543-5047 for service of this equipment.

Draeger Medical, Inc. also recommends that its anesthesia equipment be serviced at three-month intervals. Periodic Manufacturer's Service Agreements are available for equipment manufactured by Draeger Medical, Inc. For further information concerning these agreements, please contact us at (800) 543-5047.

Draeger Medical, Inc. products/material in need of factory repair shall be sent to:

DrägerService
3124 Commerce Drive
Telford, PA 18969
(Include RMA Number)

HOW TO USE THIS MANUAL

The manual is divided into several sections. The DIAGNOSTICS section describes self-test and service diagnostics for checking the system functions. An understanding of the on-board service capabilities is necessary before any attempt is made to troubleshoot the unit. The TROUBLESHOOTING section lists error codes and provides troubleshooting guides to assist the TSR in locating the source of a problem. The REPLACEMENT PROCEDURES section contains instructions for removal and replacement of the assemblies that are considered field-replaceable. The ADJUSTMENT AND CALIBRATION PROCEDURES section contains the field procedures needed to restore original system specifications. The Periodic Manufacturer's Service (PMS) PROCEDURE section outlines the steps required to verify the electrical, mechanical and pneumatic safety of the unit and also identifies components requiring periodic replacement.

GENERAL TROUBLESHOOTING GUIDELINES

Troubleshooting the Narkomed 3 should always begin by communicating with those who observed or experienced a problem with the unit. This may eliminate unnecessary troubleshooting steps. Once a general problem is identified, refer to the troubleshooting flow charts in Section 3 to determine the proper corrective action to be taken.

After a component has been replaced, verify that the unit is operating properly by running the appropriate diagnostic procedure. The PMS PROCEDURE in Section 6 must also be performed after any component has been replaced.

The general arrangement of the Narkomed 3 Anesthesia System is shown on the opposite page.

WARNINGS are used in this manual before procedures which if not performed correctly could result in personal injury.

CAUTIONS are used in this manual to alert service personnel to the possibility of damage to the equipment if a procedure is not performed correctly.

Copyright

Copyright © 1997 by Draeger Medical, Inc. All rights reserved. No part of this publication may be reproduced, transmitted, transcribed, or stored in a retrieval system in any form or by any means, electronic or mechanical, including photocopying and recording, without the written permission of Draeger Medical, Inc.

Trademark Notices

CliniDAS, Datagrip, NAD Information Systems, NAD Logo, Narkomed, O.R. Data Manager, O.R. Link, ORM, PC Prep/View, Quality Service For Life, Vigilance Audit, Vitalert, Vitalink and Narkomed GS are registered trademarks of Draeger Medical, Inc. All other products or name brands are trademarks of their respective owners.

Disclaimer

The content of this manual is furnished for informational use only and is subject to change without notice. Draeger Medical, Inc. assumes no responsibility or liability for any errors or inaccuracies that may appear in this manual.

2.0 DIAGNOSTICS

When the Narkomed 3 is powered up, each of the monitors performs a six-second self-diagnostic check and lamp test. The display window on each monitor should show a power-up code number, and all LED indicators and backlit labels should illuminate. The left-hand CRT will then show the Centralert Alarm display and the right-hand CRT will show the Data display.

Table 2-1 lists the possible error codes that may appear in monitor display windows at power-up or during subsequent use. Record any error codes that appear and communicate them to the NAD Service Department, or Authorized Service center during any troubleshooting effort.

Following the completion of the monitor self-tests, the Technical Service Representative (TSR) can call up service screens at the display panel. The following paragraphs describe each service screen. If no display is present on the Centralert Alarm CRT or the Data CRT, refer to Section 3 of this manual for troubleshooting assistance.

TABLE 2-1: NARKOMED 3 ERROR CODES

ERROR CODE	DESCRIPTION
E00	ROM error
E01	RAM error
E02	ADC did not start conversion
E03	ADC conversion too long
E04	ADC reading out of range (overflow)
E05	CTC error
E06	Calibration error
E07	Communication lost
E08	Shorted switch (switch closed for >30 seconds)
E09	Non-functional pneumatic control element
E10	ADC reference out of range

2.1 Service Selection Screen

To access the Service Selection Screen, press and hold the LOG DATA key and the hidden key directly to the right of the LOG DATA key, then press the CHECKOUT key. The Service Selection screen appears as shown in Figure 2-1.

The Service Selection Screen displays the available service functions. Access to these service functions is gained through the Centralert CRT control keys below the service screen which temporarily function according to their corresponding on-screen labels. The SELECT key advances the cursor to the desired menu option, and the ENTER key opens the selected service screen. Pressing the END CONFIGURE key exits the Service Selection Screen. This screen also exits automatically after two minutes have elapsed.

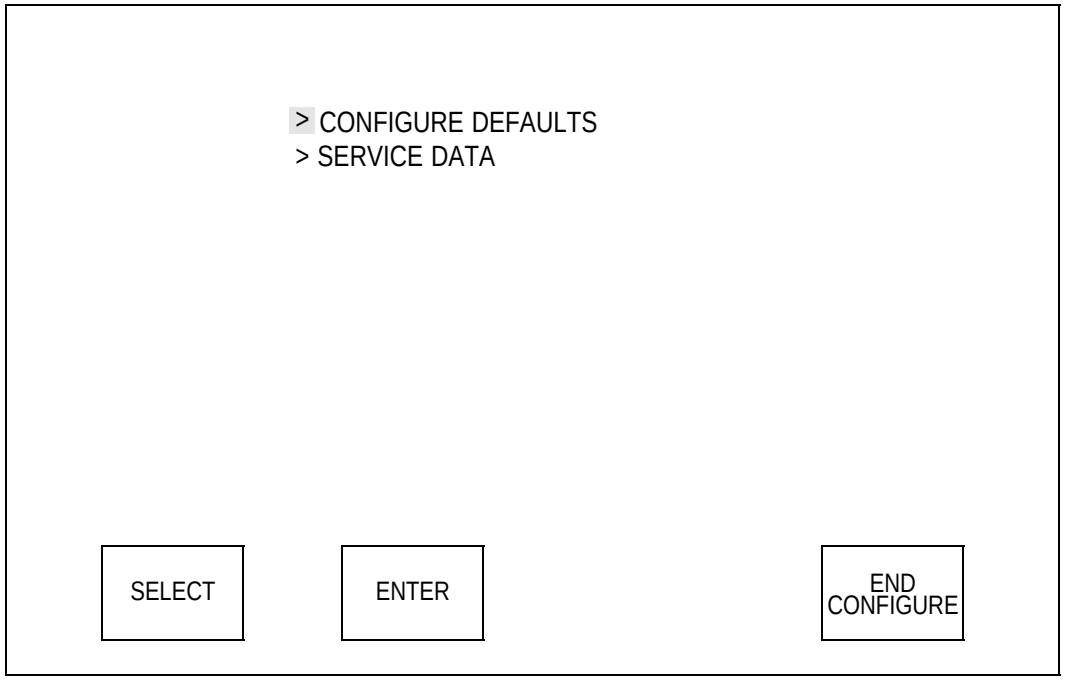


Figure 2-1: SERVICE SELECTION SCREEN

2.2 Configuration Screen

To access the Configuration Screen, press the SELECT key (see Figure 2-1) to advance the cursor to the CONFIGURE DEFAULTS option, and then press the ENTER key. Figure 2-2 shows the Configuration Screen.

This screen allows the TSR to set power-up default alarm limits and display selections for each monitor in the machine. The default values are stored with the SAVE key. Press the END CONFIGURE key to return to the Service Selection Screen. The Configuration Screen also exits automatically after two minutes have elapsed.

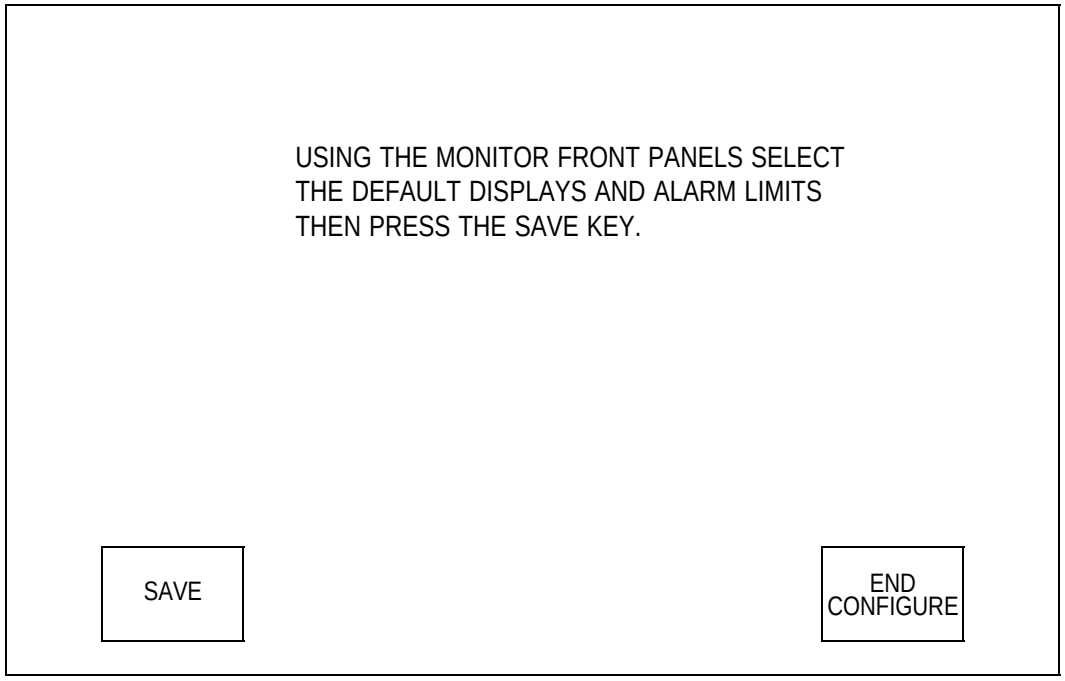


Figure 2-2: CONFIGURATION SCREEN

2.3 Service Data Screen

To access the Service Data Screen, press the SELECT key (see Figure 2-1) to advance the cursor to the SERVICE DATA option, and then press the ENTER key. This screen allows the TSR to view and reset the last service date and shows the total number of hours of machine usage. It also displays the software versions of the system subassemblies. A typical Service Data Screen is shown in Figure 2-3.

The Hours Since Serviced and Service Date are reset by pressing the RESET key. Pressing the END CONFIGURE key returns the TSR to the Service Selection Screen.

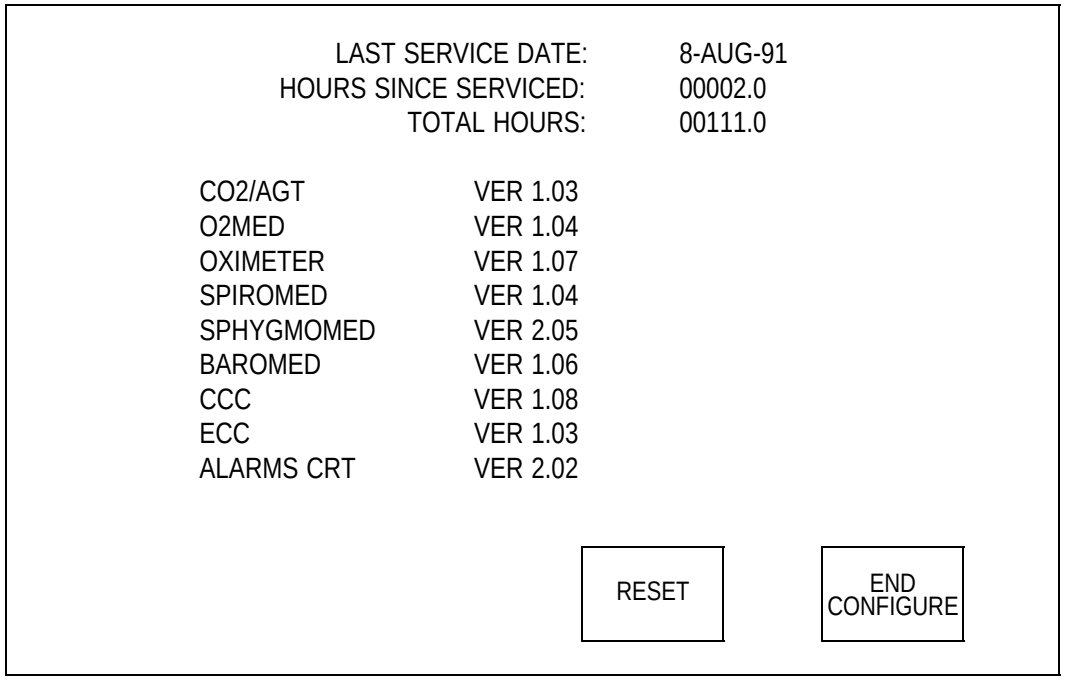


Figure 2-3: SERVICE DATA SCREEN

3.0 TROUBLESHOOTING

This section contains information to assist the Draeger Medical, Inc. qualified Technical Service Representative (TSR) in locating electrical faults affecting the NARKOMED 3 monitoring and display devices. Since most troubleshooting efforts begin with verifying power supply voltages, the following paragraphs outline the voltage distribution scheme within the machine along with connector pin identification and wire colors.

Also contained in this section are troubleshooting guide flow charts that provide a method of tracing faults to specific field replaceable assemblies or sub-assemblies in response to observed failure modes or symptoms.

3.1 Power Supply and Voltage Distribution

In the NARKOMED 3, power for the monitors and CRT displays is distributed from a terminal block located in the rear of the monitor housing. This terminal block is accessible by opening the back cover of the monitor housing. Figure 3-1 shows the terminal block inputs and main DC power wiring harness connections to the power controller PCB assembly.

Table 3-1 shows the nominal DC voltages at the power distribution block and their acceptable tolerances , under normal load with rated AC voltage applied to the machine and the System Power switch set to ON.

Table 3-1: DISTRIBUTION BLOCK VOLTAGES

WIRE COLOR	NOMINAL VOLTAGE WITH RESPECT TO COMMON	ACCEPTABLE RANGE
Gray	+7.4 Unswitched Memory Backup	+7.1 to +7.7
Purple	-8 Vital	-7.75 to -8.25
Yellow	+12 Non-Vital	+11.7 to +12.3
Orange	+8 Non-Vital	+7.75 to +8.25
Red	+8 Vital	+7.75 to +8.25

Figure 3-2 shows the power distribution from the terminal block to the field replaceable assemblies and CRTs, and also to the backplanes which provide power distribution to the monitors.

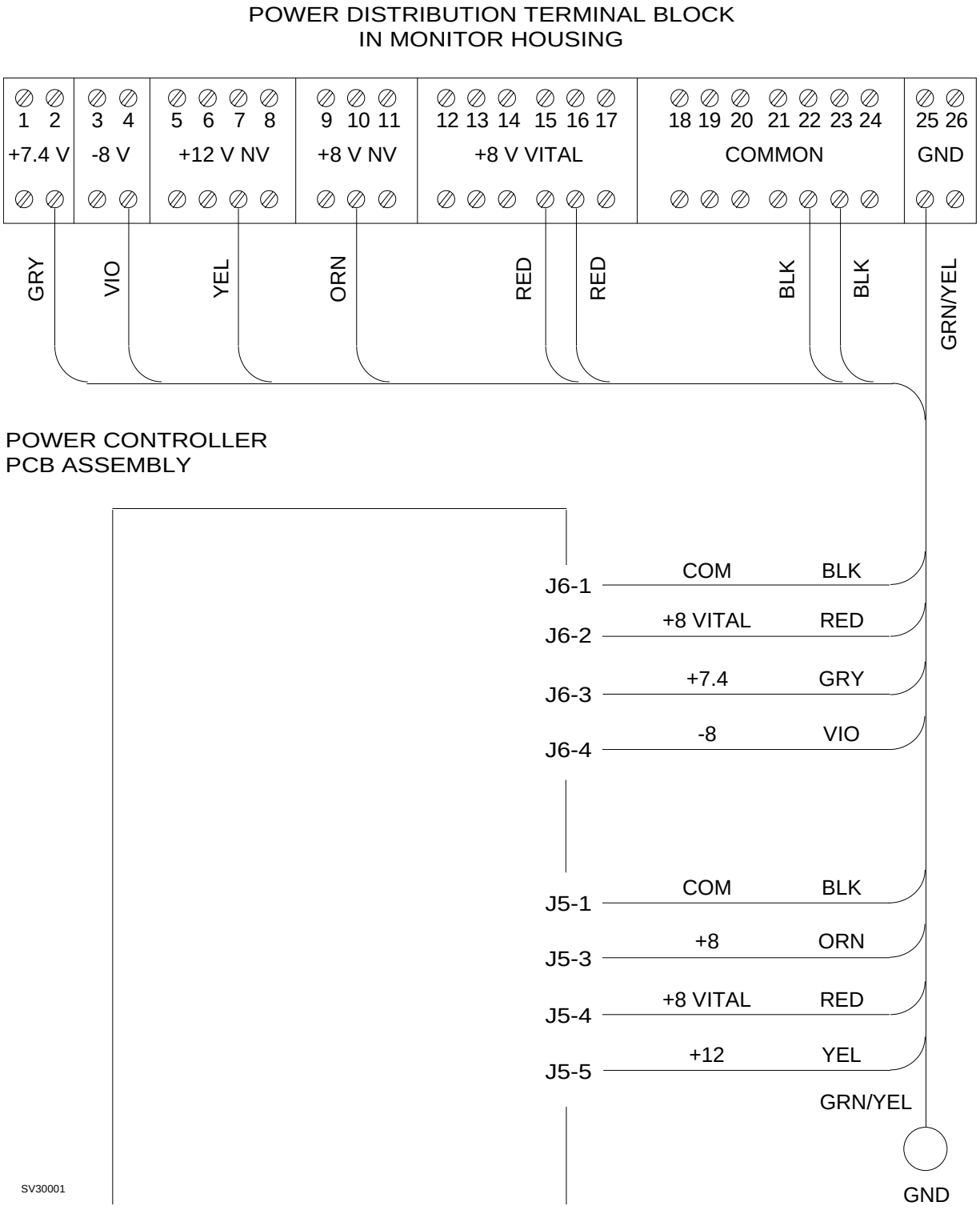


Figure 3-1: INPUTS TO POWER DISTRIBUTION BLOCK

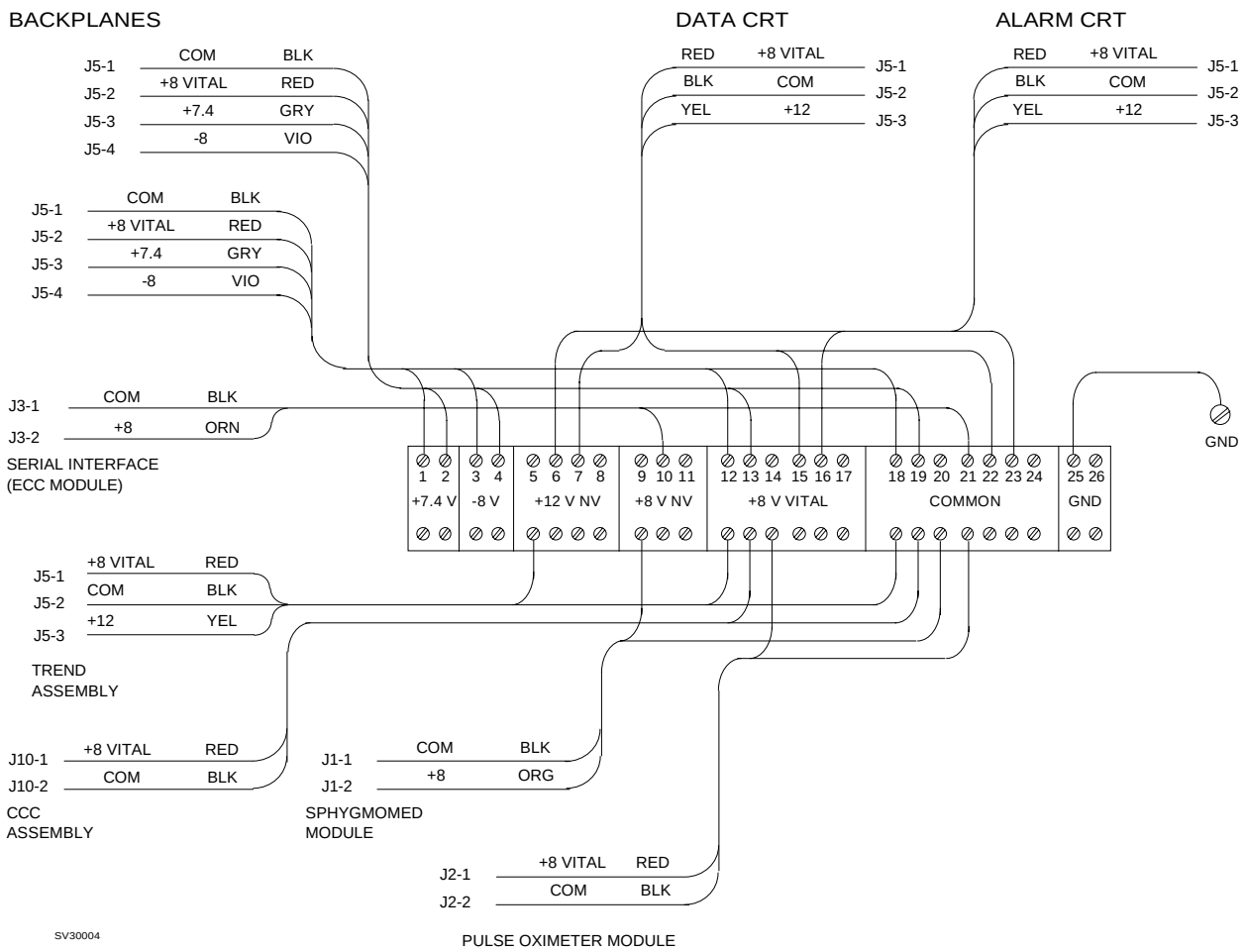


Figure 3-2: POWER DISTRIBUTION - NM3 MONITOR HOUSING

3.2 Multispec Analyzer Power Supply

The multispec analyzer is powered by a separate supply located in the secondary power supply compartment directly above the power controller PCB assembly. Table 3-2 lists the nominal DC voltages at the output connector on the multispec power supply and their acceptable tolerances, under normal load with rated AC voltage applied to the machine and the System Power switch set to ON.

Table 3-2: MULTISPEC POWER SUPPLY VOLTAGES

CONNECTOR AND PIN	NOMINAL VOLTAGE	ACCEPTABLE RANGE
J2-1	+5 VDC	+4.88 to +5.12
J2-2		
J2-3		
J2-4		
J2-5	+5 V return	
J2-6		
J2-7		
J2-8	+15 VDC	+14.66 to +15.34
J2-9		
J2-10		
J2-11	+15 V return	
J2-12		
J2-13	-15 V return	-14.09 to -15.91
J2-14	-15 VDC	

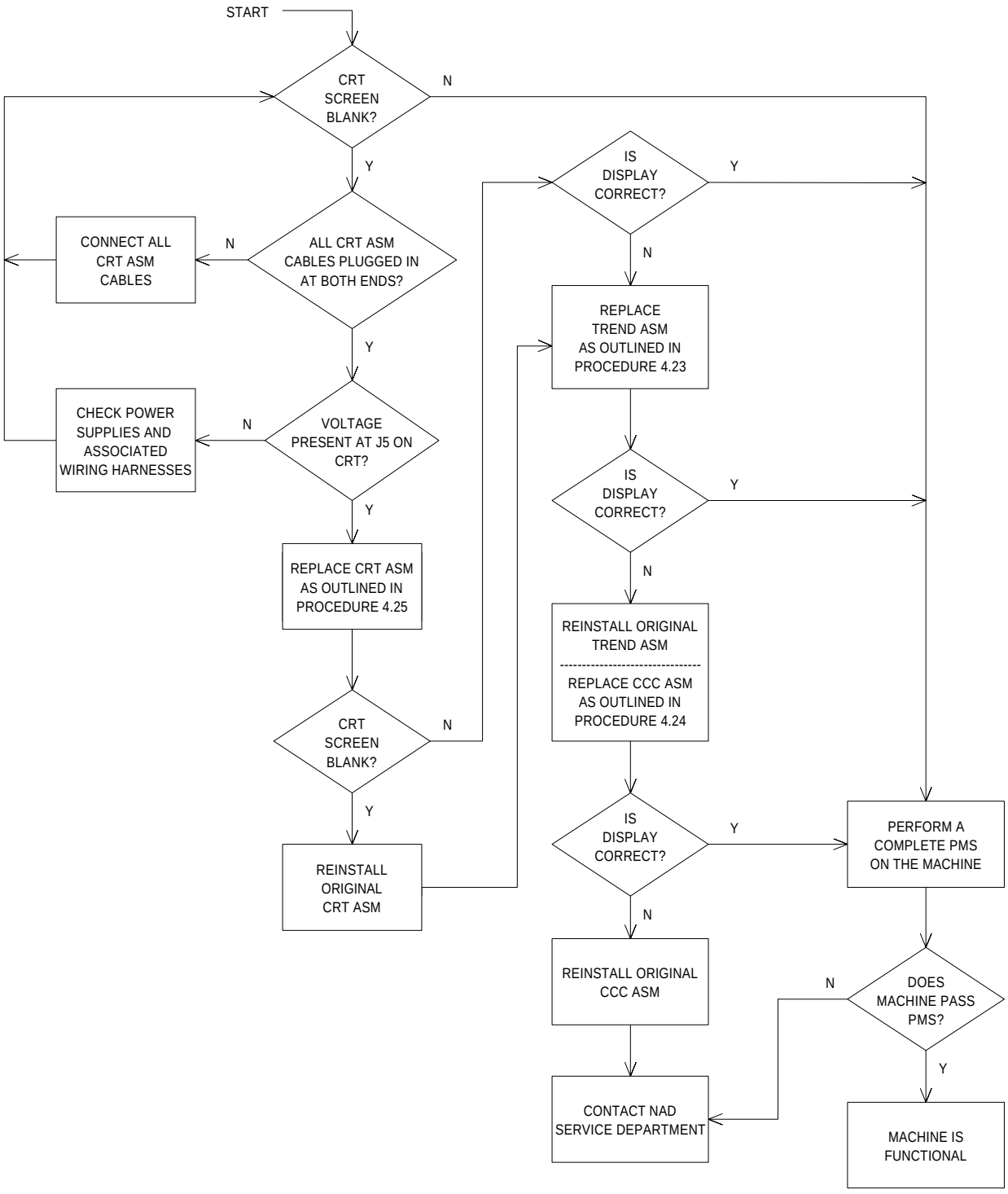
3.3 Troubleshooting Guide Flow Charts

Table 3-3 lists several common possible failure modes and symptoms (excluding simultaneous multiple faults) for the monitoring devices in the NARKOMED 3. Each failure mode or symptom is keyed to a troubleshooting guide flow chart to assist the Technical Service Representative in locating a problem. These flow charts assume that the machine is plugged into an AC outlet with the correct voltage, and the machine is not running on its backup battery.

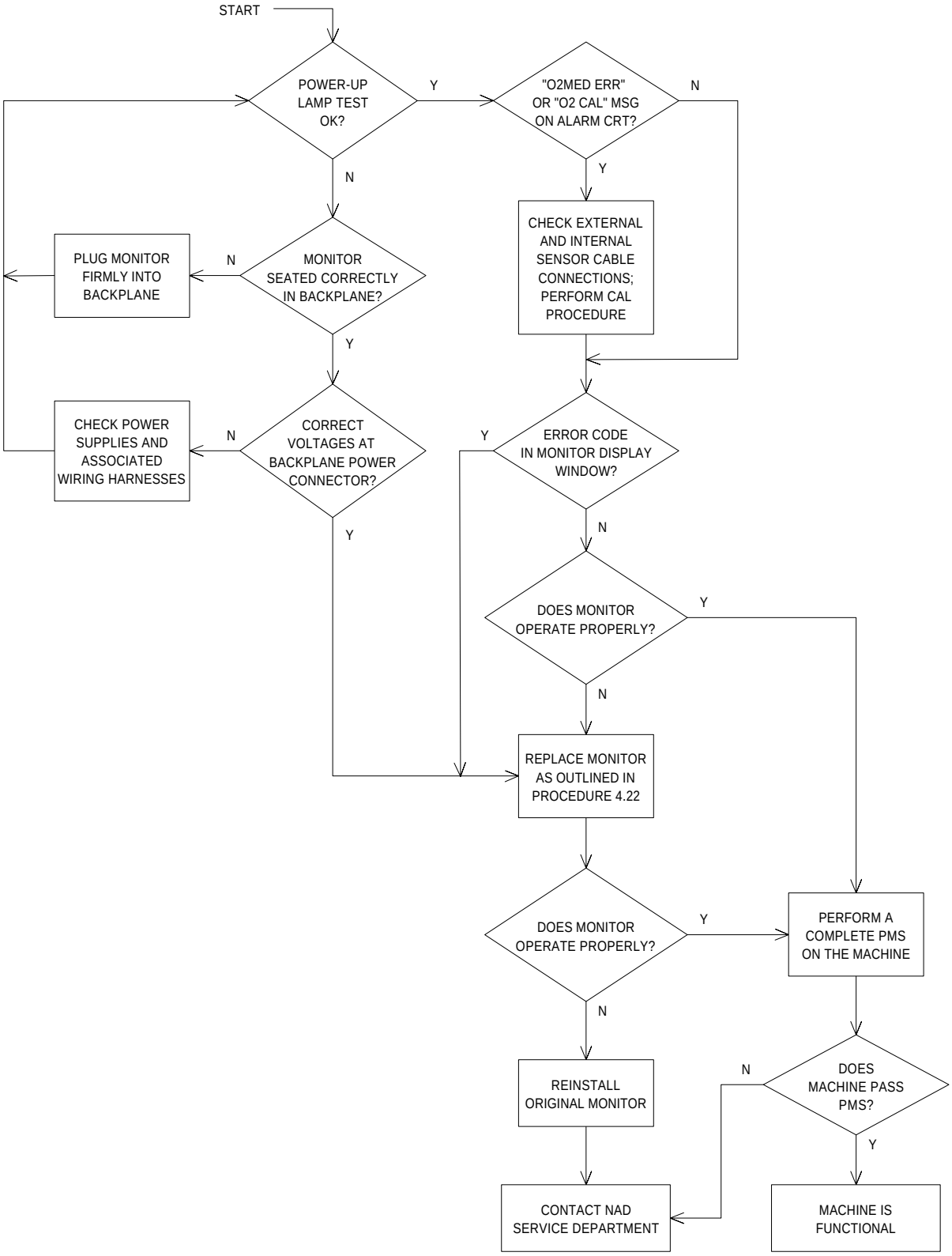
Table 3-3: NARKOMED 3 TROUBLESHOOTING GUIDES

FAILURE MODE / SYMPTOM	CORRECTIVE ACTION
CRT Screen Blank or Incorrect Display	Guide 1
O2MED Monitor Inoperative	Guide 2
BAROMED Monitor Inoperative	Guide 3
SaO2 Monitor Inoperative	Guide 4
SPIROMED Monitor Inoperative	Guide 5
SPHYGMOMED Monitor Inoperative	Guide 6
MULTISPEC Monitor and Analyzer Errors	Guide 7
Serial Interface Communication Failure	Guide 8
Loss of Keypad Response	Guide 9

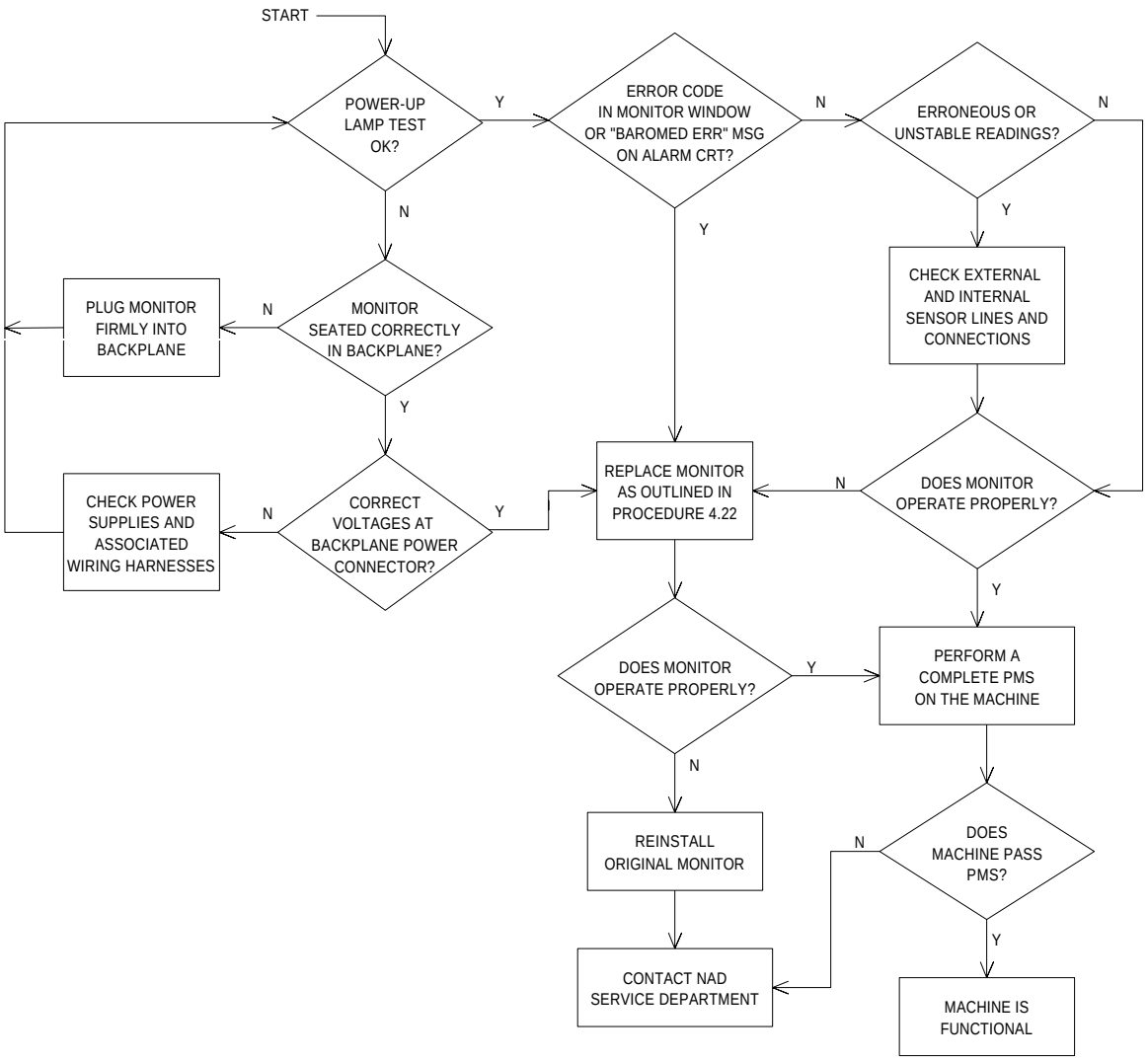
GUIDE 1: CRT Screen Blank or Incorrect Display



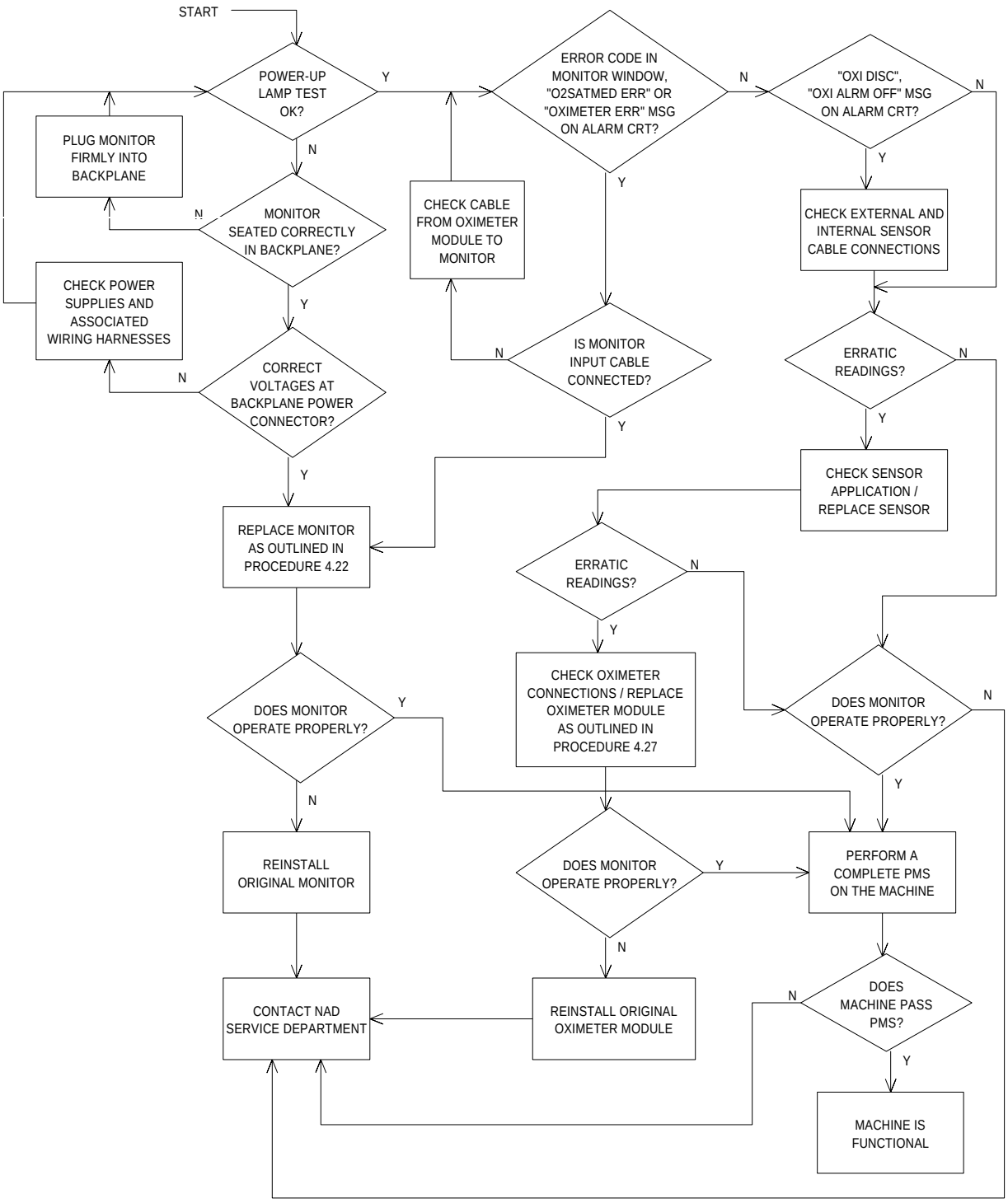
GUIDE 2: O2MED Monitor Inoperative



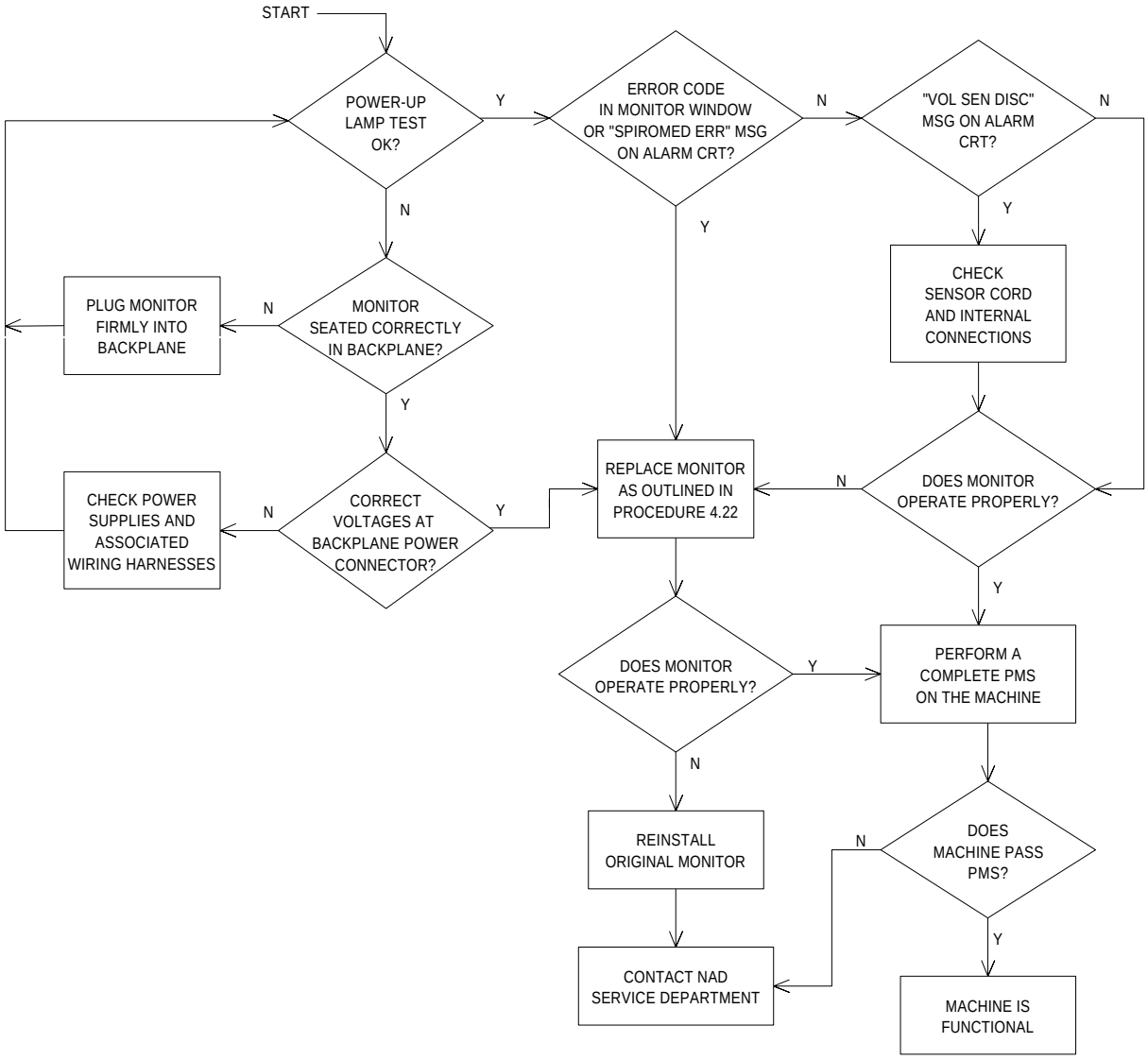
GUIDE 3: BAROMED Monitor Inoperative



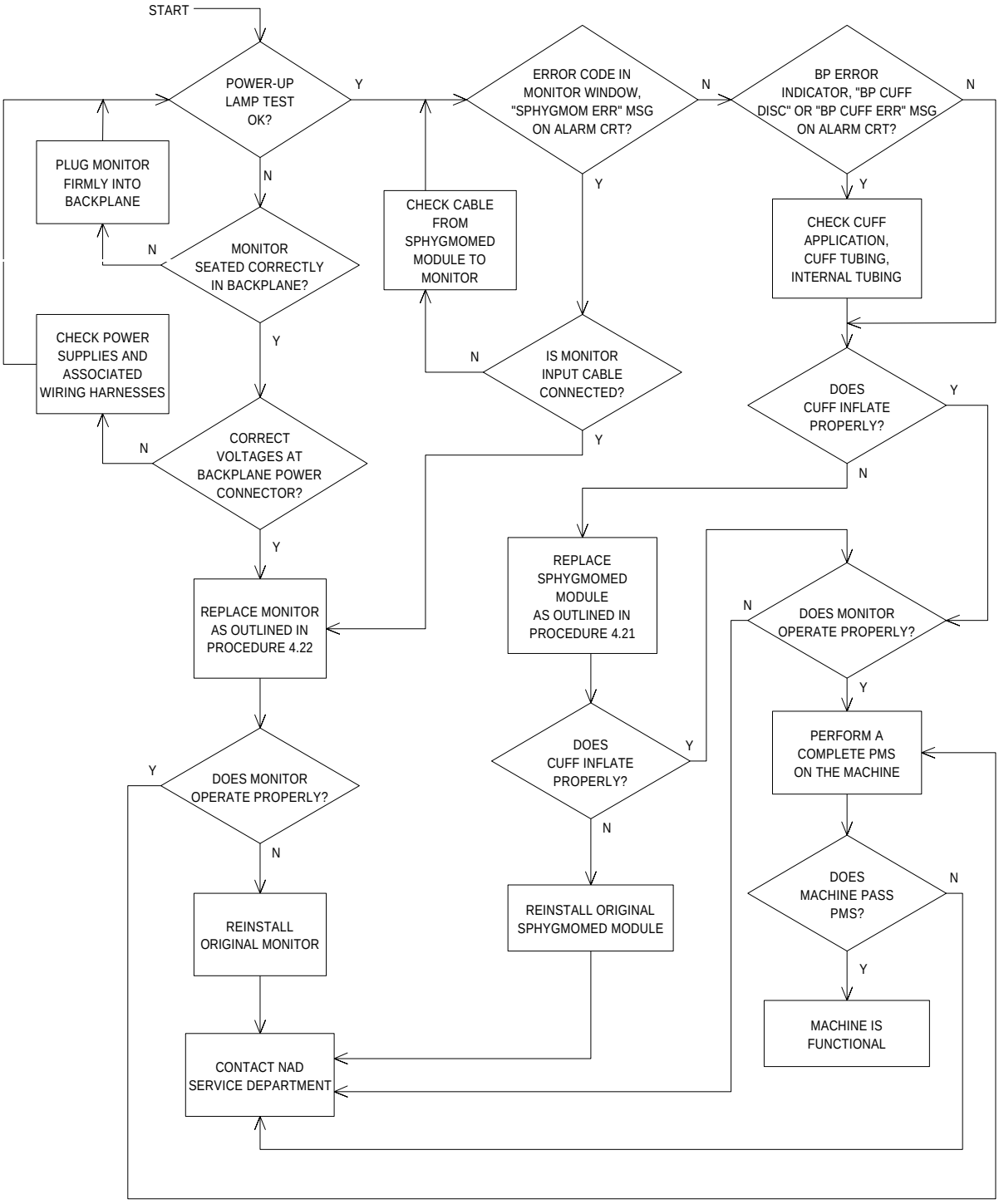
GUIDE 4: SaO2 Monitor Inoperative



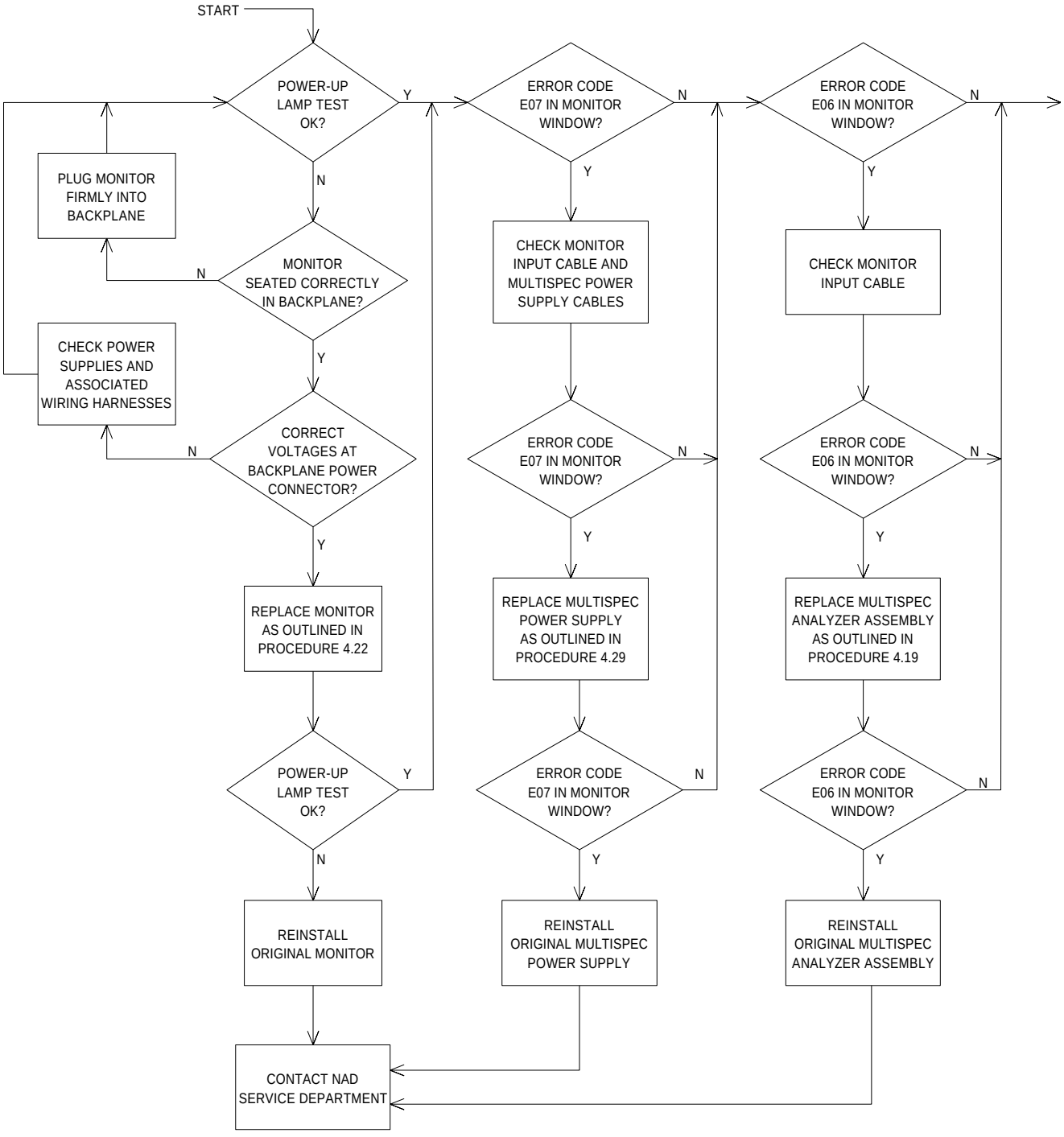
GUIDE 5: SPIROMED Monitor Inoperative



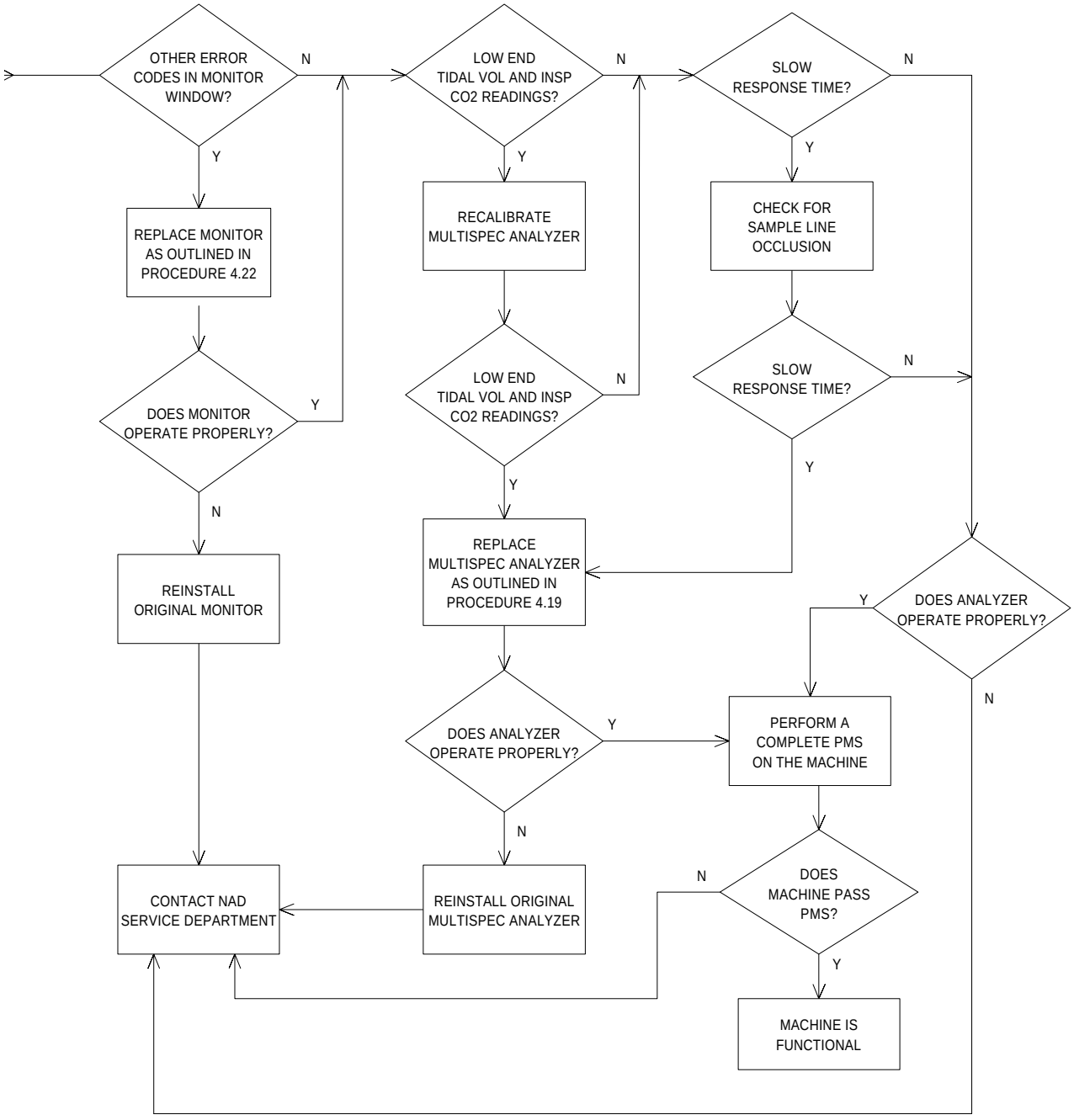
GUIDE 6: SPHYGMOMED Monitor Inoperative



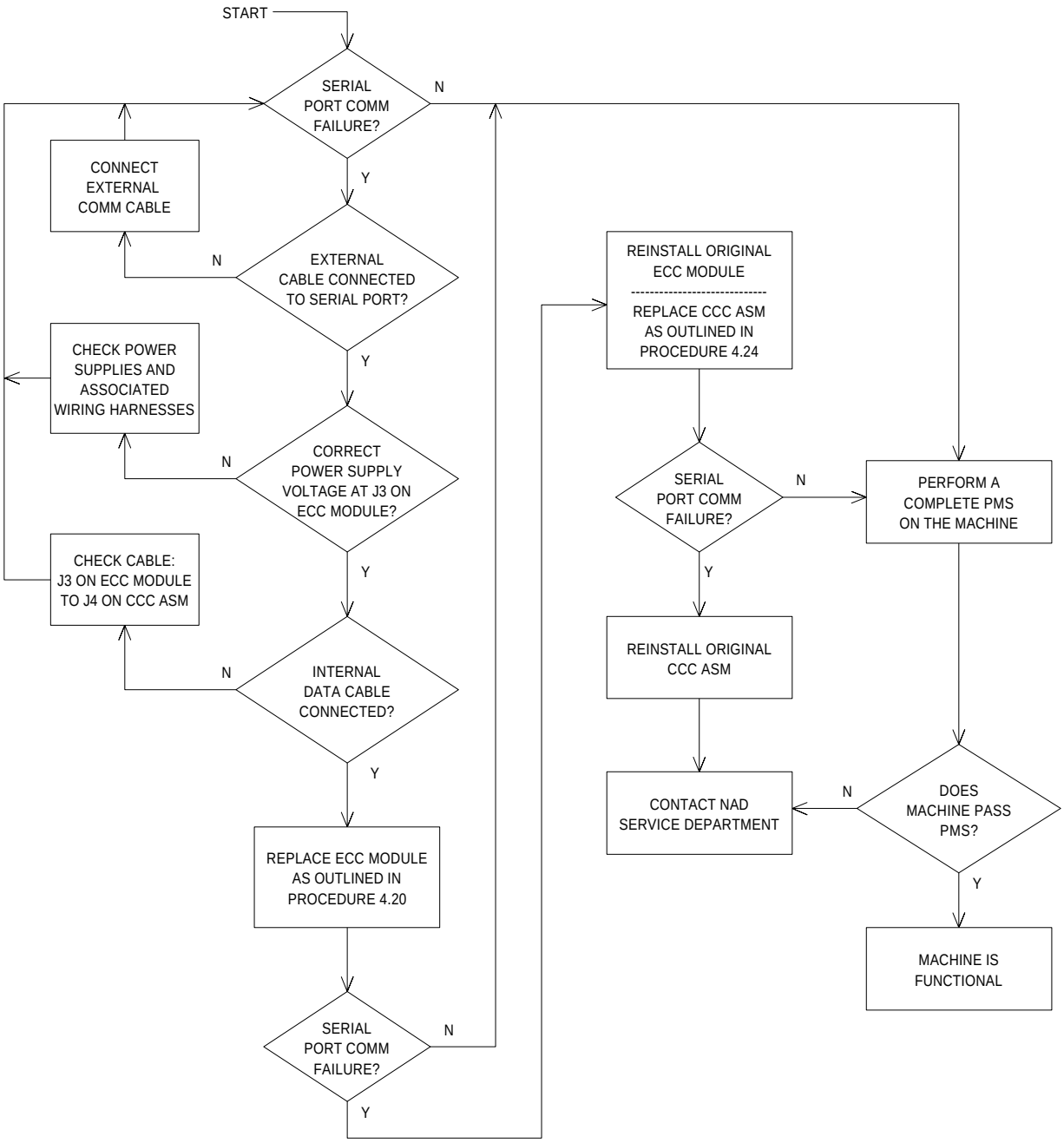
GUIDE 7: MULTISPEC Monitor and Analyzer Errors



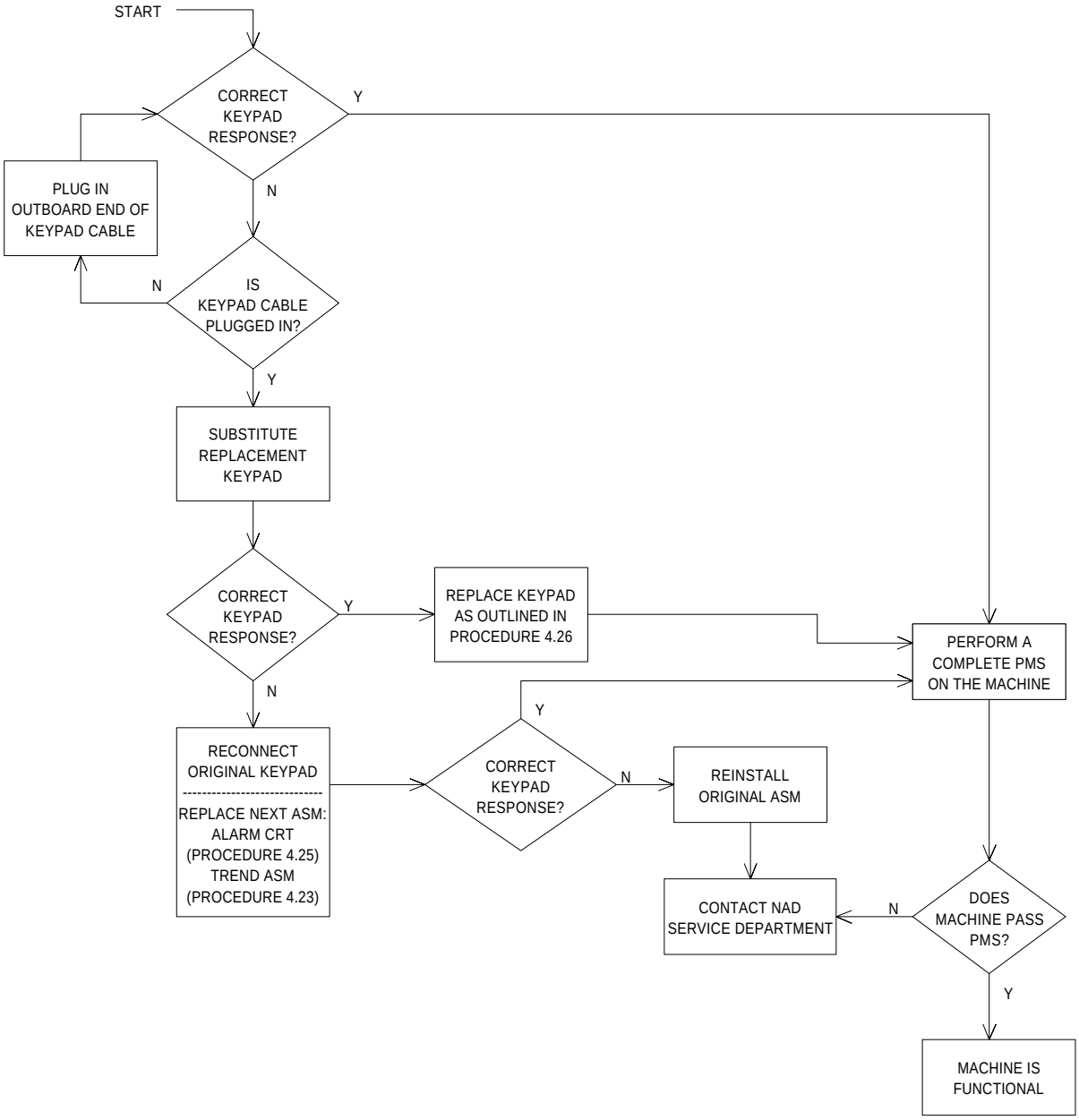
GUIDE 7 (continued): MULTISPEC Monitor and Analyzer Errors



GUIDE 8: Serial Interface Communication Failure



GUIDE 9: Loss of Keypad Response



RETURN TO THIS MANUAL'S TABLE OF CONTENTS
RETURN TO CD-ROM TABLE OF CONTENTS

4.0 REPLACEMENT PROCEDURES

This section outlines removal and replacement procedures for the field-replaceable assemblies of the NARKOMED 3 Anesthesia System.

These procedures are to be performed only by a Draeger Medical, Inc. qualified Technical Service Representative (TSR).

The following are the only procedures authorized by Draeger Medical, Inc. to be performed in the field. All other service procedures shall be referred to NAD's Technical Service Department.

NOTE: **The PMS PROCEDURE given in Section 6 must be performed after any replacement, removal, calibration or adjustment procedure.**

4.1 Cylinder Yoke Assemblies

Each cylinder yoke contains a replaceable filter and check valve assembly. Replacement of this assembly requires that the yoke be removed from the anesthesia machine. Figure 4-1 shows a typical cylinder yoke mounting arrangement. Access to the yoke mounting screws and gas line connection requires that the table top be removed from the machine.

4.1.1 Disconnect all pipeline hoses and set the System Power switch to ON.

4.1.2 Close all cylinder valves except the O_2 valve.

4.1.3 Set the oxygen flow to 5 liters per min.

4.1.4 Open the other gas flow control valves to drain pressure from the system.

4.1.5 Close the O_2 cylinder valve, and close the flow control valves. Press the O_2 Flush valve to drain oxygen pressure from the system.

4.1.6 Set the System Power switch to STANDBY.

4.1.7 Remove the cylinder where the yoke is to be replaced.

WARNING: Store the cylinder in a safe place and lay it on its side.

4.1.8 Remove the screws holding the table top to the machine and lift out the table top.

4.1.9 Pull the writing or keyboard tray out to its fully extended position.

4.1.10 Disconnect the gas line fitting at the yoke and remove the two yoke mounting screws.

4.1.11 Remove the filter and check valve assembly from the yoke and install a replacement assembly.

If the entire yoke assembly is being replaced, ensure that the replacement yoke has the correct label and pin indexing arrangement.

NOTE: If the yoke spacer is removed from the frame rail of the machine, be sure to re-install it in its original position.

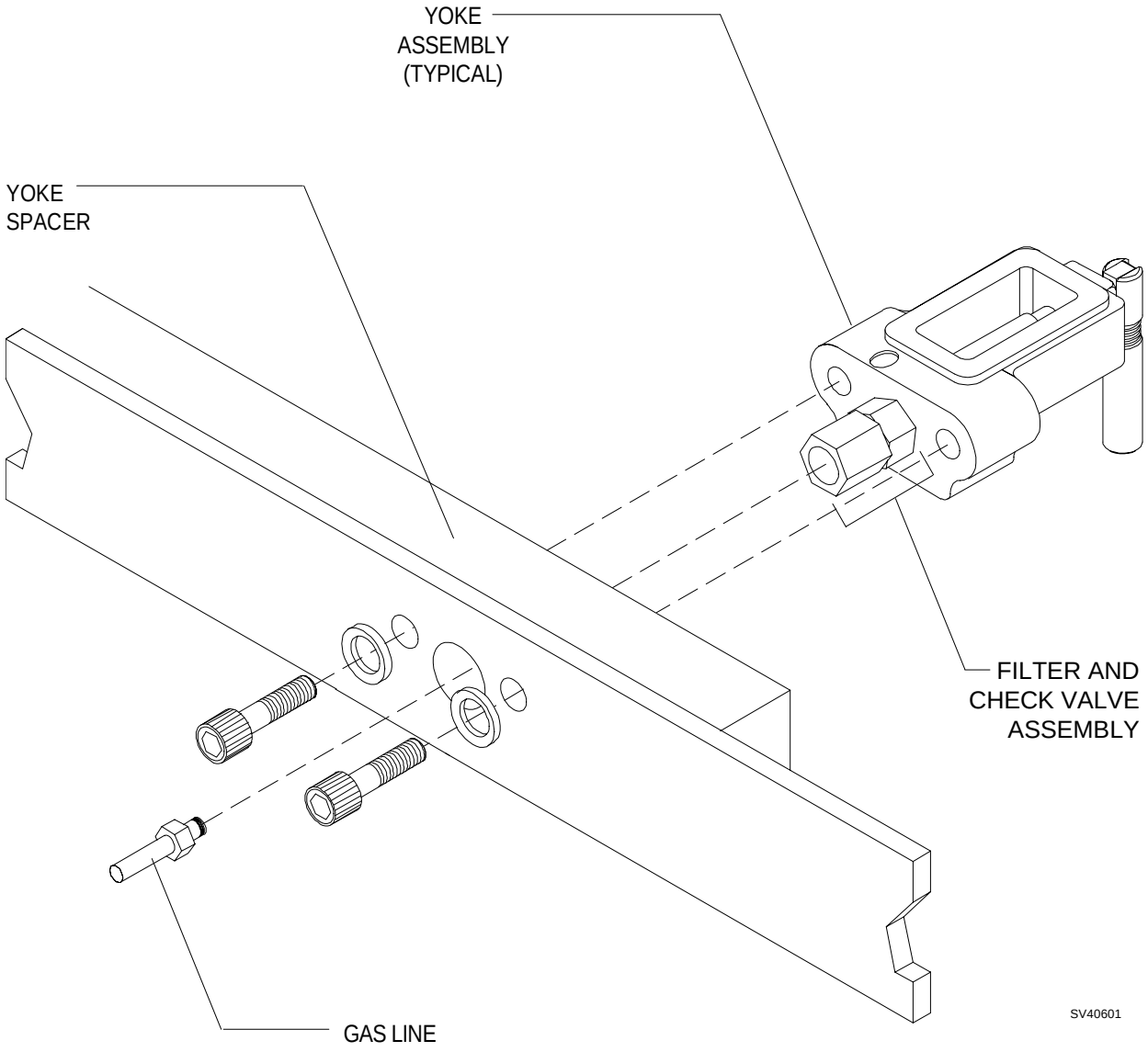


Figure 4-1: CYLINDER YOKE ASSEMBLY

4.1.12 Position the yoke on the spacer, and install the two mounting screws and lockwashers. Tighten the screws securely. Connect the gas line fitting to the yoke.

4.1.13 If a new cylinder is being installed, remove the old sealing washer from the gas inlet of the yoke and install a new washer.

4.1.14 Install the correct cylinder in the yoke, making sure that the index pins are properly engaged before tightening the handle bolt. The cylinder should hang vertically after the handle is tight.

4.1.15 Perform the following leak test on the yoke assembly:

4.1.15.1 Open the cylinder valve and check for a pressure indication on the corresponding gauge at the gas instrumentation panel.

NOTE: The cylinder used for this test must contain the following minimum pressure:

O_2	: 1000 PSI
N_2O	: 700 PSI
HE	: 1000 PSI
CO_2	: 800 PSI
AIR	: 1000 PSI
N_2	: 1000 PSI

4.1.15.2 Close the cylinder valve and remove the cylinder from the yoke.

4.1.15.3 For any gas, the pressure should not drop more than 50 PSI in two minutes.

4.1.16 Re-install the cylinder in the yoke.

4.1.17 Replace the table top and its retaining screws.

4.1.18 Replace the pipeline hoses.

4.1.19 Perform the PMS Procedure given in Section 6.

4.2 Cylinder Pressure Regulators

Access to the cylinder pressure regulators requires that the table top be removed from the anesthesia machine. Figure 4-2 shows the mounting arrangement of the regulators and typical connections.

NOTE: For Canada machines the replacement procedure is similar, but different part numbers apply to the regulator assemblies. Refer to Section 8 for the listing of part numbers.

4.2.1 Disconnect all pipeline hoses and set the System Power switch to ON.

4.2.2 Close all cylinder valves except the O_2 valve.

4.2.3 Set the oxygen flow to 5 liters per min.

4.2.4 Open the other gas flow control valves to drain pressure from the system.

4.2.5 Close the O_2 cylinder valve, and close the flow control valves. Press the O_2 Flush valve to drain oxygen pressure from the system.

4.2.6 Set the System Power switch to STANDBY.

4.2.7 Remove the cylinder corresponding to the regulator to be replaced.

4.2.8 Remove the screws holding the table top to the machine and lift out the table top.

4.2.9 Remove the top drawer from the cabinet and pull the writing or keyboard tray out to its fully extended position.

4.2.10 Disconnect the three compression fittings at the regulator.

4.2.11 Loosen the two setscrews holding the regulator to its mounting bracket and remove the regulator.

4.2.12 Record the serial number of the regulator that was removed, and record the serial number of the replacement regulator.

4.2.13 Position the replacement regulator in its mounting bracket, and connect the three compression fittings. Do not tighten the fittings yet.

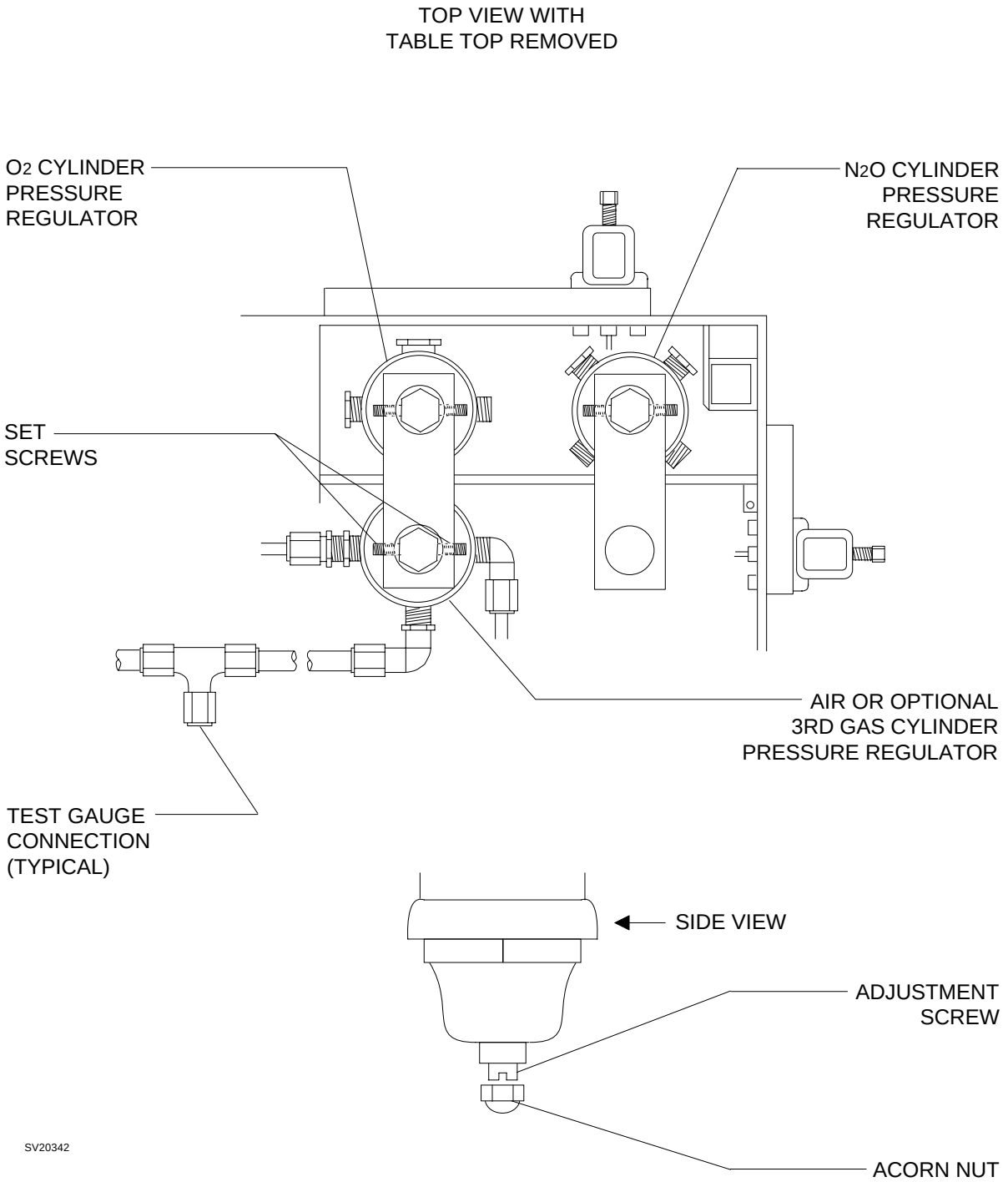


Figure 4-2: CYLINDER PRESSURE REGULATORS

4.2.14 Tighten the regulator mounting setscrews to a torque of 50 to 55 in. lbs.

4.2.15 Tighten the compression fittings.

4.2.16 Locate the TEE fitting in the ¼ in. diameter regulator output line, and remove the plug from the TEE fitting.

4.2.17 Connect a test gauge to the TEE fitting.

4.2.18 Install the cylinder that was previously removed.

4.2.19 Open the O_2 cylinder valve and set the System Power switch to ON.

4.2.20 Set the oxygen flow to 4 liters per min.

4.2.21A For the O_2 pressure regulator:

The test gauge should indicate between 43 and 49 PSI.

4.2.21B For the other pressure regulators:

Open the corresponding cylinder valve and set the gas flow to 4 liters per min. (900 ml per min. for CO_2).

The test gauge should indicate between 43 and 49 PSI. (27 and 33 PSI for CO_2).

4.2.22 If the regulator output pressure is not within the correct range, remove the acorn nut on the bottom of the regulator to expose the adjusting screw. Turn the screw until the test gauge indicates in the correct range, and replace the acorn nut.

4.2.23 Close the cylinder valve and allow pressure to drain from the system.

4.2.24 Close all of the flow control valves and set the System Power switch to STANDBY.

4.2.25 Disconnect the test gauge from the TEE fitting and replace the plug in the fitting.

4.2.26 Perform the following leak test on the high pressure side of the regulator:

4.2.26.1 Open the cylinder valve and check for a pressure indication on the corresponding gauge at the gas instrumentation panel.

NOTE: The cylinder used for this test must contain the following minimum pressure:

O_2 : 1000 PSI
N_2O : 700 PSI
HE : 1000 PSI
CO_2 : 800 PSI
AIR : 1000 PSI
N_2 : 1000 PSI

4.2.26.2 Close the cylinder valve and remove the cylinder from the yoke.

4.2.26.3 For any gas, the pressure should not drop more than 50 PSI in two minutes.

4.2.27 Re-install the cylinder in the yoke.

4.2.28 Replace the table top and its retaining screws.

4.2.29 Replace the top drawer in the cabinet.

4.2.30 Connect the pipeline hoses.

4.2.31 Perform the PMS Procedure given in Section 6.

4.3 Cylinder Cutoff Valves (Canada)

Access to the cylinder cutoff valves requires removal of the table top from the anesthesia machine. Figure 4-3 shows the locations of the O_2 and N_2O cutoff valve assemblies. For machines equipped with a third gas, the tubing arrangement is similar to the N_2O cutoff valve assembly.

4.3.1 Disconnect all pipeline hoses and set the System Power switch to ON.

4.3.2 Close all cylinder valves except the O_2 valve.

4.3.3 Set the oxygen flow to 5 liters per min.

4.3.4 Open the other gas flow control valves to drain pressure from the system.

4.3.5 Close the O_2 cylinder valve, and close the flow control valves. Press the O_2 Flush valve to drain oxygen pressure from the system.

4.3.6 Set the System Power switch to STANDBY.

4.3.7 Remove the screws holding the table top to the machine and lift out the table top.

4.3.8 Remove the top drawer from the cabinet and pull the writing or keyboard tray out to its fully extended position.

4.3.9 Disconnect the compression fittings indicated at points marked C on the illustration.

4.3.10 Cut the tie-wrap clamp and disconnect the flexible tubing from the cutoff valve assembly at the point marked A on the illustration.

4.3.11 Remove the cylinder cutoff assembly.

4.3.12 Connect the flexible tubing to the replacement cutoff valve assembly and secure it with a new tie-wrap clamp.

4.3.13 Connect and tighten the compression fittings at points marked C on the illustration.

4.3.14 Perform the following test:

-- Remove the plug from the test gauge connection at the Tee fitting in the regulator outlet piping, and install a test gauge.

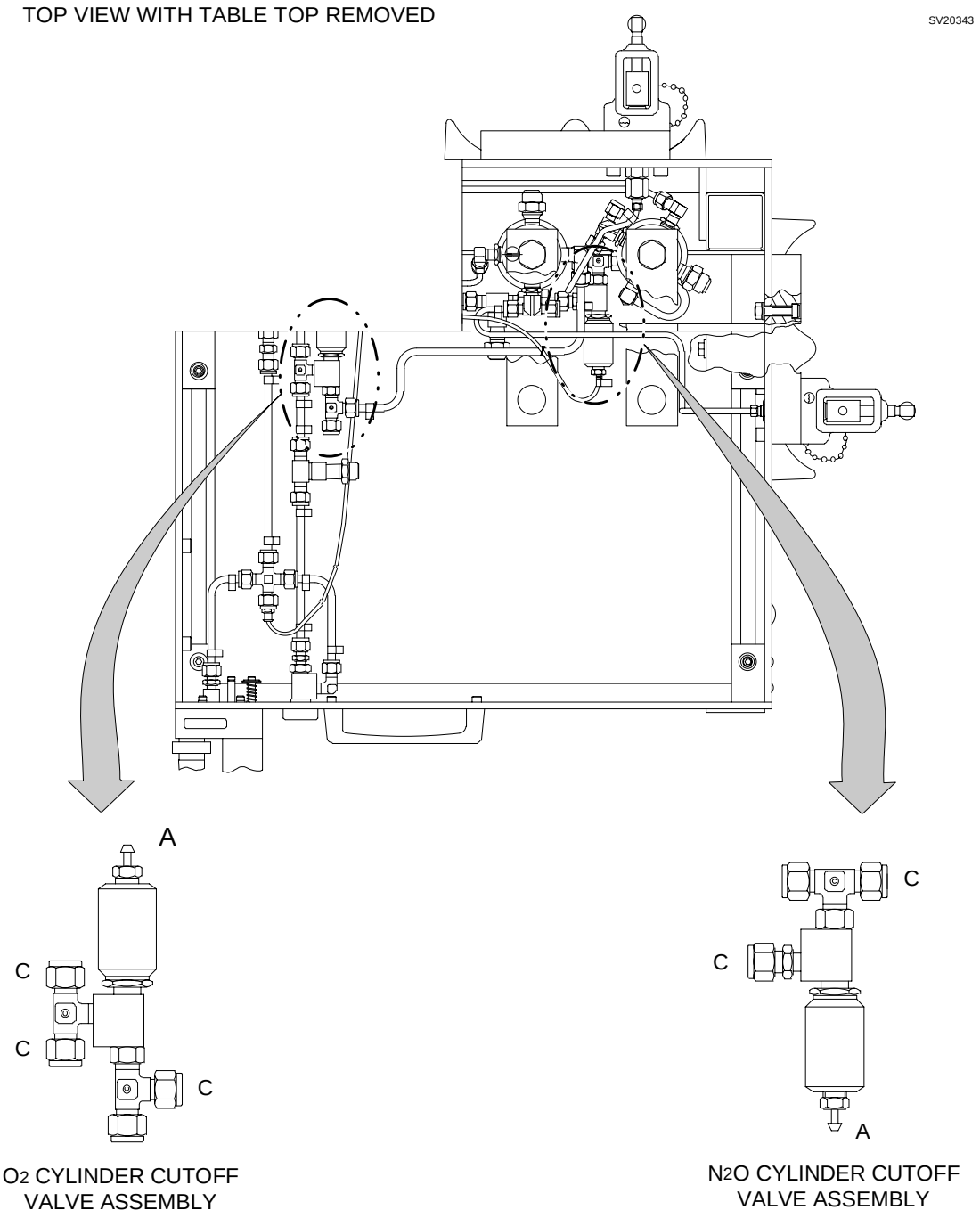


Figure 4-3: CYLINDER CUTOFF VALVES (CANADA)

NOTE: The cylinders used for this test must contain the following minimum pressure:

O_2 : 1000 PSI
AIR : 1000 PSI
O_2+He : 1000 PSI
N_2O : 745 PSI

-- Set the System Power switch to ON.

-- For the O_2 cutoff valve: open the O_2 cylinder valve and set the oxygen flow to 4 liters per min.

-- For the N_2O cutoff valve: open the O_2 cylinder valve and the N_2O cylinder valve. Set each flow to 4 liters per min.

-- Verify that regulator outlet pressure is between 43 and 49 PSI.

-- Connect the pipeline hoses and pressurize to 50 PSI.

-- Turn off the pipeline supply and observe the pipeline pressure gauge.

-- The cutoff valve shall open when the pipeline pressure drops through the range of 45 to 40 PSI.

-- Close the cylinder valve(s), and close the flow control valve(s).

-- Disconnect test pressure gauge and reinstall the plug in the regulator outlet piping.

4.3.15 Replace the table top and its retaining screws.

4.3.16 Replace the top drawer in the cabinet.

4.3.17 Connect the pipeline hoses.

4.3.18 Perform the PMS Procedure given in Section 6.

4.4 Cylinder and Pipeline Pressure Gauges

Replacement of the cylinder and pipeline pressure gauges requires that the plexiglass front cover be removed from the gas instrumentation panel, and also the rear cover for access to the gauge connections. Figure 4-4 shows disassembly and mounting details.

4.4.1 Disconnect all pipeline hoses and set the System Power switch to ON.

4.4.2 Close all cylinder valves except the O_2 valve.

4.4.3 Set the oxygen flow to 5 liters per min.

4.4.4 Open the other gas flow control valves to drain pressure from the system.

4.4.5 Close the O_2 cylinder valve, and close the flow control valves. Press the O_2 Flush valve to drain oxygen pressure from the system.

4.4.6 Set the System Power switch to STANDBY.

NOTE: Steps 4.4.8 thru 4.4.12 apply to later machines with a one-piece flowmeter and gauge cover.

4.4.7 Remove the screws holding the rear cover, and remove the cover.

4.4.8 Remove the screws holding the table top to the machine and lift out the table top.

4.4.9A Early models: Remove the two screws (from the back) holding the front plate at the top of the plexiglass cover. Hold the front plate as the screws are removed from the back.

4.4.9B Later models (without the O_2/N_2O ratio alarm lamp): Remove the six screws holding the flowmeter shield and vapor box cover panel, and remove the panel.

4.4.10 Remove the O_2 flow control knob. The knob has two setscrews.

NOTE: If the knob must be rotated to allow access to a setscrew, carefully note its position so that it can be re-assembled in the same position with the "Off Stop" properly set.

4.4.11 Remove the two screws holding the knob guard in place, and remove the knob guard. (For earlier machines with the bar-type knob guard, the screws holding the guard assembly are accessible through the back of the flowmeter housing.)

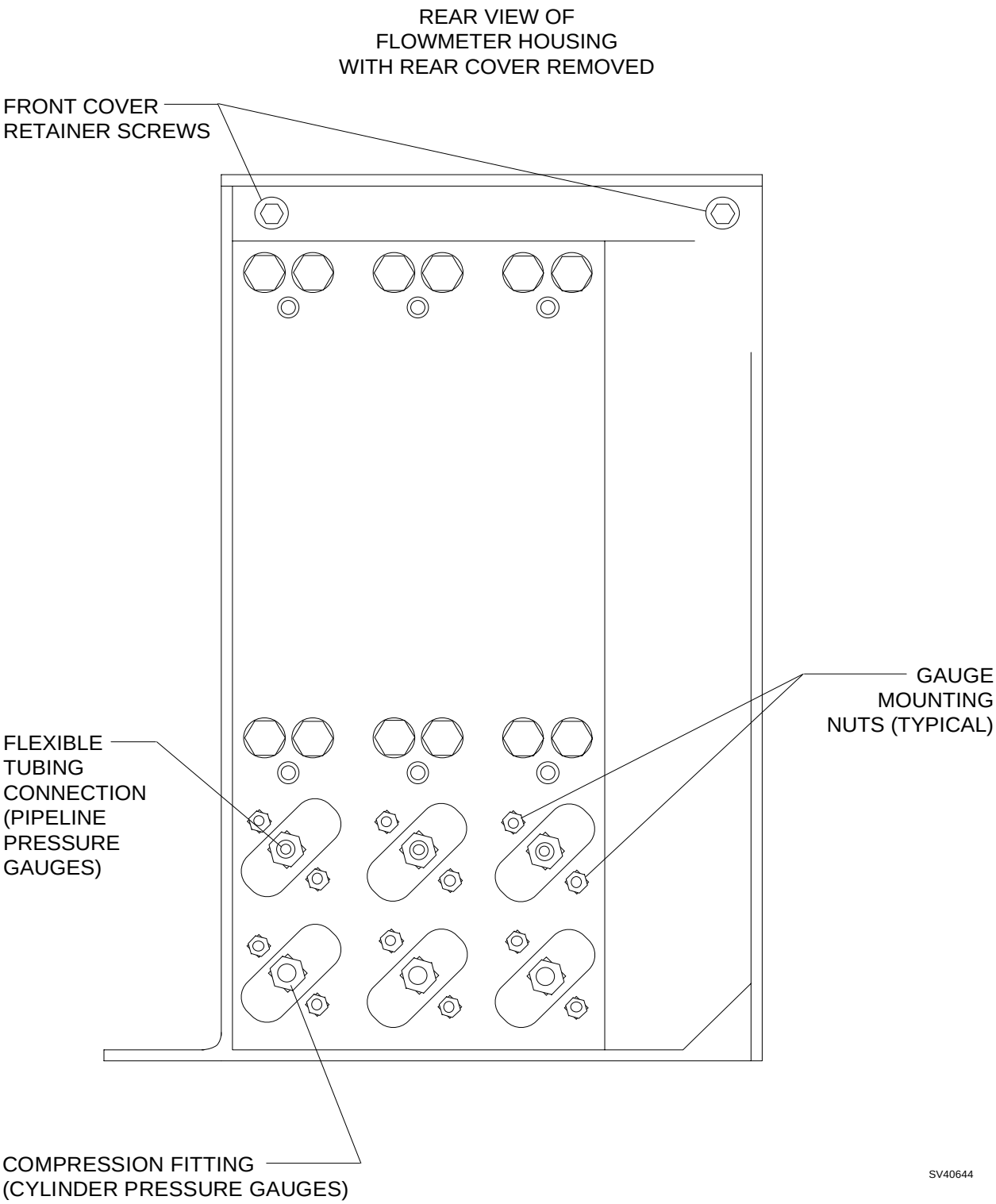


Figure 4-4: CYLINDER AND PIPELINE PRESSURE GAUGES

4.4.12 Remove the screws holding the plexiglass cover over the flow tubes and gauges, and carefully remove the cover.

NOTE: Intermediate assemblies may need to be removed to allow access to the gauge connections and mounting hardware. Be sure to keep a record of the disassembly sequence so that all tubing can be correctly re-assembled.

4.4.13A For the cylinder pressure gauges:

Disconnect the compression fitting at the back of the gauge.

Remove the gauge mounting nuts and washers, and remove the gauge from the front of the panel.

NOTE: If applicable, transfer the gauge cover (lens) from the original gauge to the replacement gauge.

Install the replacement gauge in the panel using the flat washers, lock washers and mounting nuts that were previously removed.

Connect the gas line to the gauge and tighten the compression fitting.

4.3.13B For the pipeline pressure gauges:

Locate the flexible tubing connecting the gauge to the pipeline inlet assembly, cut the tie-wrap tubing clamp at the pipeline inlet and disconnect the tubing.

Remove the gauge mounting nuts and washers, and remove the gauge from the front of the panel.

Cut the tie-wrap tubing clamp and disconnect the flexible tubing from the gauge.

Connect a new 7-inch length of tubing (8-inch for the air pipeline pressure gauge) to the replacement gauge and secure it with a new tie-wrap clamp.

Place the gauge in the panel and secure it with the flat washers, lock washers and mounting nuts that were previously removed.

Connect the other end of the flexible tubing to the pipeline inlet assembly and secure it with a tie-wrap clamp.

4.4.14 If a cylinder pressure gauge was replaced, perform the following leak test:

4.4.14.1 Open the cylinder valve and check for a pressure indication on the corresponding gauge at the gas instrumentation panel.

NOTE: The cylinder used for this test must contain the following minimum pressure:

O_2 : 1000 PSI
N_2O : 700 PSI
HE : 1000 PSI
CO_2 : 800 PSI
AIR : 1000 PSI
N_2 : 1000 PSI

4.4.14.2 Close the cylinder valve and remove the cylinder from the yoke.

4.4.14.3 For any gas, the pressure should not drop more than 50 PSI in two minutes.

4.4.15 Reinstall the cylinder in the yoke.

NOTE: Steps 4.4.16 thru 4.4.19 apply to later machines with a one-piece flowmeter and gauge cover.

4.4.16 Place the plexiglass cover over the gauges and flow tubes, and reinstall the cover screws. Do not over-tighten these screws as the plexiglass may crack.

4.4.17 Place the knob guard over the flow control valves and install its two retaining screws. (Reinstall the bar-type knob guard on earlier machines.)

4.4.18 Reinstall the O_2 flow control knob and tighten its setscrews. If the knob is installed properly, the O_2 label will be straight when the knob is against its clockwise stop.

4.4.19 Replace the front cover plate at the top of the plexiglass cover and secure it with the hardware that was previously removed.

4.4.20 Replace the rear cover and its retaining screws.

4.4.21 Replace the table top and its retaining screws.

4.4.22 Connect the pipeline hoses.

4.4.23 Perform the PMS Procedure given in Section 6.

4.5 Flowmeters

The flowmeter tubes are held by compression in gaskets at the top and bottom of each tube. Each upper gasket is seated in an adjustable retainer that allows removal of the tube as shown in Figure 4-5. Access to the flow tubes and their retainers requires removal of the plexiglass cover on the gas instrumentation panel.

4.5.1 Disconnect all pipeline hoses and set the System Power switch to ON.

4.5.2 Close all cylinder valves except the O_2 valve.

4.5.3 Set the oxygen flow to 5 liters per min.

4.5.4 Open the other gas flow control valves to drain pressure from the system.

4.5.5 Close the O_2 cylinder valve, and close the flow control valves. Press the O_2 Flush valve to drain oxygen pressure from the system.

4.5.6 Set the System Power switch to STANDBY.

4.5.7 Remove the screws holding the rear cover, and remove the cover.

NOTE: Steps 4.5.8, 4.5.10, and 4.5.11 apply to later machines with a one-piece flowmeter and gauge cover.

4.5.8 Remove the screws holding the table top to the machine and lift out the table top.

4.5.9A Early models: Remove the two screws (from the back) holding the front plate at the top of the plexiglass cover. Hold the front plate as the screws are removed from the back.

4.4.9B Later models (without the O_2/N_2O ratio alarm lamp): Remove the six screws holding the flowmeter shield and vapor box cover panel, and remove the panel.

4.5.10 Remove the O_2 flow control knob. The knob has two setscrews.

NOTE: If the knob must be rotated to allow access to a setscrew, carefully note its position so that it can be re-assembled in the same position with the "Off Stop" properly set.

4.5.11 Remove the two screws holding the knob guard in place, and remove the knob guard. (For earlier machines with the bar-type knob guard, the screws holding the guard assembly are accessible through the back of the flowmeter housing.)

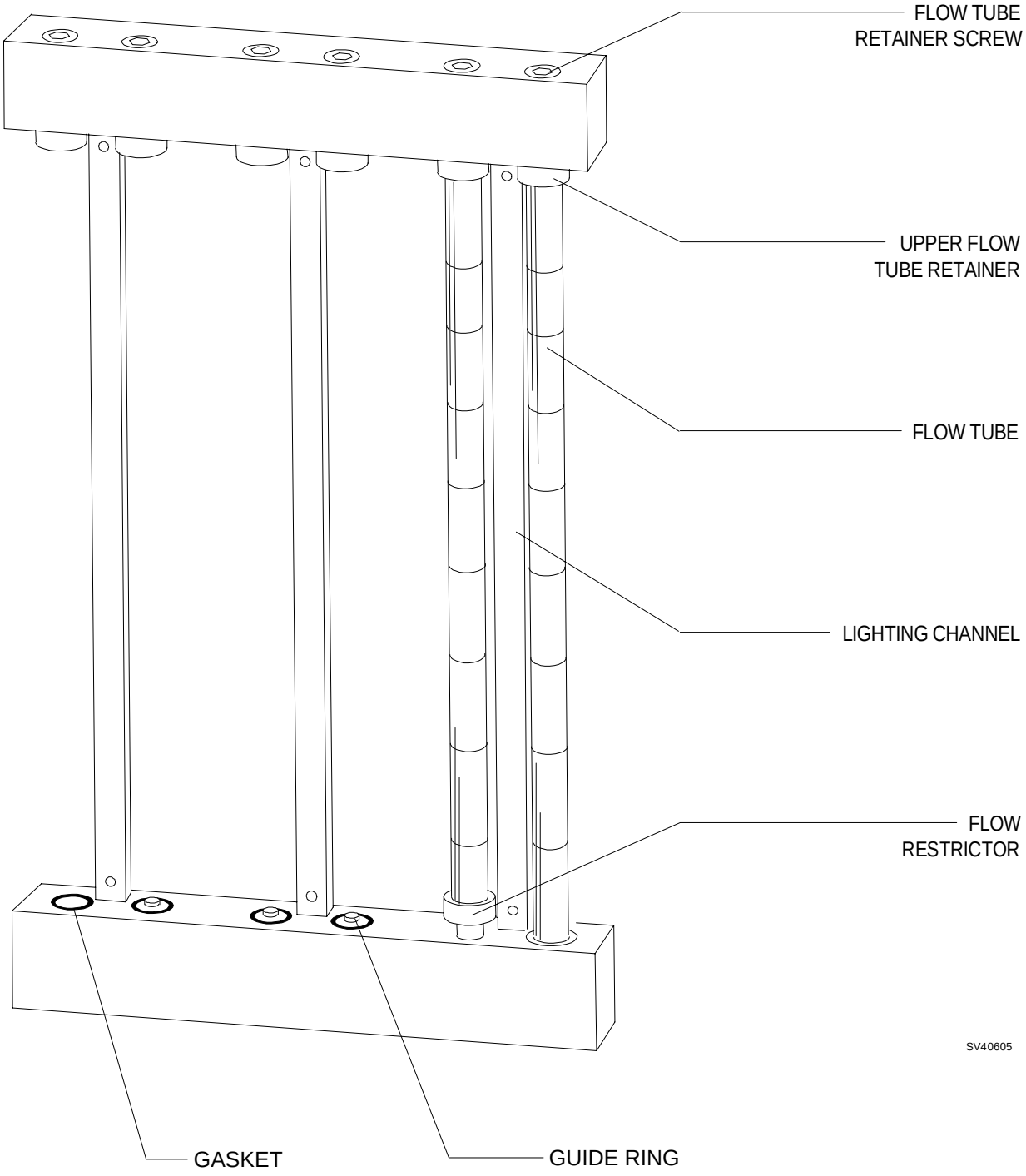


Figure 4-5: FLOWMETERS

4.5.12 Remove the screws holding the plexiglass cover over the flow tubes and gauges, and carefully remove the cover.

4.5.13 Loosen the screw directly above the flowmeter tube to be replaced. Turning the screw counter clockwise will raise the upper flow tube retainer. Raise the retainer far enough to be able to pull the top of the tube outward, and remove the tube.

NOTE: If the bottom of the tube is seated in a flow restrictor, be sure that the arrangement of the restrictor and its gaskets is not disturbed.

4.5.14 Make sure that the replacement flow tube bears the correct markings and has a ball.

4.5.15 Place the bottom of the flowmeter tube into the guide ring of the lower gasket seal, and position the top of the flow tube into the center guide ring of the top gasket seal. It will be easier to hold the tube if the adjacent lighting channel is pulled forward and temporarily removed.

CAUTION: The flowmeter tube must be properly centered over the guide rings or damage to the flowmeter tube may occur.

4.5.16 Ensure that the markings on the flow tube are facing forward, and turn the upper retainer screw clockwise until the flow tube is firmly held in place.

CAUTION: Do not over-tighten the screw as the flowmeter tube may break.

4.5.17 Perform the following leak test on the system:

4.5.17.1 Disconnect the absorber hose from the freshgas outlet.

4.5.17.2 Connect a test gauge and B.P. bulb to the freshgas outlet, and pressurize the system to 50 cm H_2O.

4.5.17.3 The pressure should not drop more than 10 cm H_2O in thirty seconds.

4.5.18 Disconnect the test gauge and re-connect the absorber hose to the freshgas outlet.

4.5.19 Replace any lighting channels that were previously removed.

4.5.20 Place the plexiglass cover over the gauges and flow tubes, and reinstall the cover screws. Do not over-tighten these screws as the plexiglass may crack.

NOTE: Steps 4.5.21, 4.5.22, and 4.5.25 apply to later machines with a one-piece flowmeter and gauge cover.

4.5.21 Place the knob guard over the flow control valves and reinstall its two retaining screws. (Reinstall the bar-type knob guard on earlier machines.)

4.5.22 Reinstall the O_2 flow control knob and tighten its setscrews. If the knob is installed properly, the O_2 label will be straight when the knob is against its clockwise stop.

4.5.23 Replace the front cover plate at the top of the plexiglass cover and secure it with the hardware that was previously removed.

4.5.24 Replace the rear cover and its retaining screws.

4.5.25 Replace the table top and its retaining screws.

4.5.26 Connect the pipeline hoses.

4.5.27 Perform the PMS Procedure given in Section 6.

4.6 Flow Control Valves

The flow control valves have replaceable elements that are removable from the front of the gas instrumentation panel as shown in Figure 4-6. Each flow control knob has a clockwise positive stop arrangement that prevents damage to the valve seat. Whenever a valve cartridge is replaced, the "off stop" must be set as outlined in the following procedure.

4.6.1 Disconnect all pipeline hoses and set the System Power switch to ON.

4.6.2 Close all cylinder valves except the O_2 valve.

4.6.3 Set the oxygen flow to 5 liters per min.

4.6.4 Open the other gas flow control valves to drain pressure from the system.

4.6.5 Close the O_2 cylinder valve and the O_2 flow control valve. Press the O_2 Flush valve to drain oxygen pressure from the system.

4.6.6 Set the System Power switch to STANDBY.

4.6.7 Remove the O_2 flow control knob, and the knob on the valve to be replaced.

4.6.8 If applicable, remove the two screws holding the knob guard in place, and remove the knob guard.

4.6.9 Remove the stop pin nut.

4.6.10 Remove the flow control valve by holding it at the wrench flats and turning it counter-clockwise.

4.6.11 Install the replacement flow control valve in the valve housing.

CAUTION: Before tightening the cartridge, rotate the valve shaft several turns counter-clockwise to prevent bottoming the valve element into the seat when the cartridge is tightened.

4.6.12 Replace the stop pin nut.

4.6.13 If applicable, replace the knob guard and secure it with the two mounting screws.

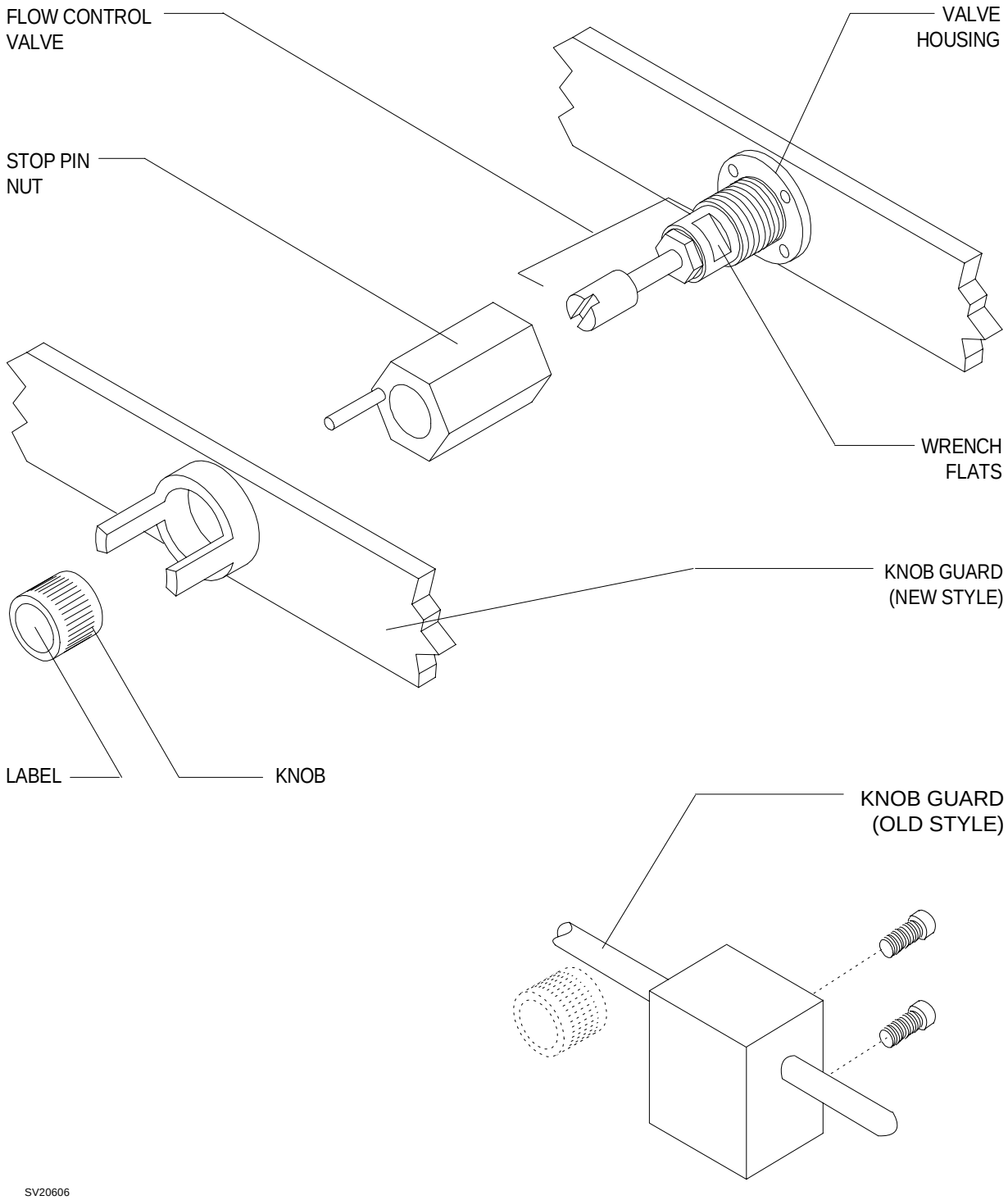


Figure 4-6: FLOW CONTROL VALVES

4.6.14 Set the System Power switch to ON.

4.6.15A For the O_2 flow control valve:

Open the oxygen cylinder valve.

Turn the flow control valve clockwise until the flow rate will not drop any further. (If the machine has been modified to eliminate the minimum flow feature, turn the valve until the flow rate is zero.)

4.6.15B For the other gas flow control valves:

Open the oxygen cylinder valve, and open the cylinder valve corresponding to the flow control valve replacement.

Set the oxygen flow rate to four liters per minute.

Turn the other gas flow control valve clockwise until the flow rate is zero.

4.6.16 Place the knob on the flow control valve shaft and turn it clockwise until it engages the stop pin. Tighten one of the knob setscrews.

4.6.17 Turn the knob in both directions and ensure that the flow can be controlled over its entire range. When the valve is closed, the knob should be against the clockwise stop. Tighten the remaining setscrew.

4.6.18 If the knob label is not horizontal when the valve is closed, remove the label and install a new label in the correct position.

4.6.19 Connect the pipeline hoses.

4.6.20 Perform the PMS Procedure given in Section 6.

4.7 Oxygen Supply Pressure Failure Protection Device

The oxygen supply failure protection devices (failsafe assemblies) are located behind the gas instrumentation panel. Access to these assemblies requires removal of the rear cover. Figure 4-7 shows a typical arrangement of a failsafe assembly and its connections. Replacement assemblies are supplied with all hardware out to the first compression fitting in each line.

4.7.1 Disconnect all pipeline hoses and set the System Power switch to ON.

4.7.2 Close all cylinder valves except the O_2 valve.

4.7.3 Set the oxygen flow to 5 liters per min.

4.7.4 Open the other gas flow control valves to drain pressure from the system.

4.7.5 Close the O_2 cylinder valve and the O_2 flow control valve. Press the O_2 Flush valve to drain oxygen pressure from the system.

4.7.6 Set the System Power switch to STANDBY.

4.7.7 Remove the screws holding the rear cover, and remove the cover.

4.7.8 Cut the tie-wrap clamp on the flexible O_2 control line, and disconnect the flexible tube.

4.7.9 Disconnect the compression fittings at the outlet and at both inlets, and remove the assembly.

4.7.10 Install the replacement failsafe assembly, and tighten the three compression fittings.

4.7.11 Connect the flexible tubing to the control port, and install a new tie-wrap clamp.

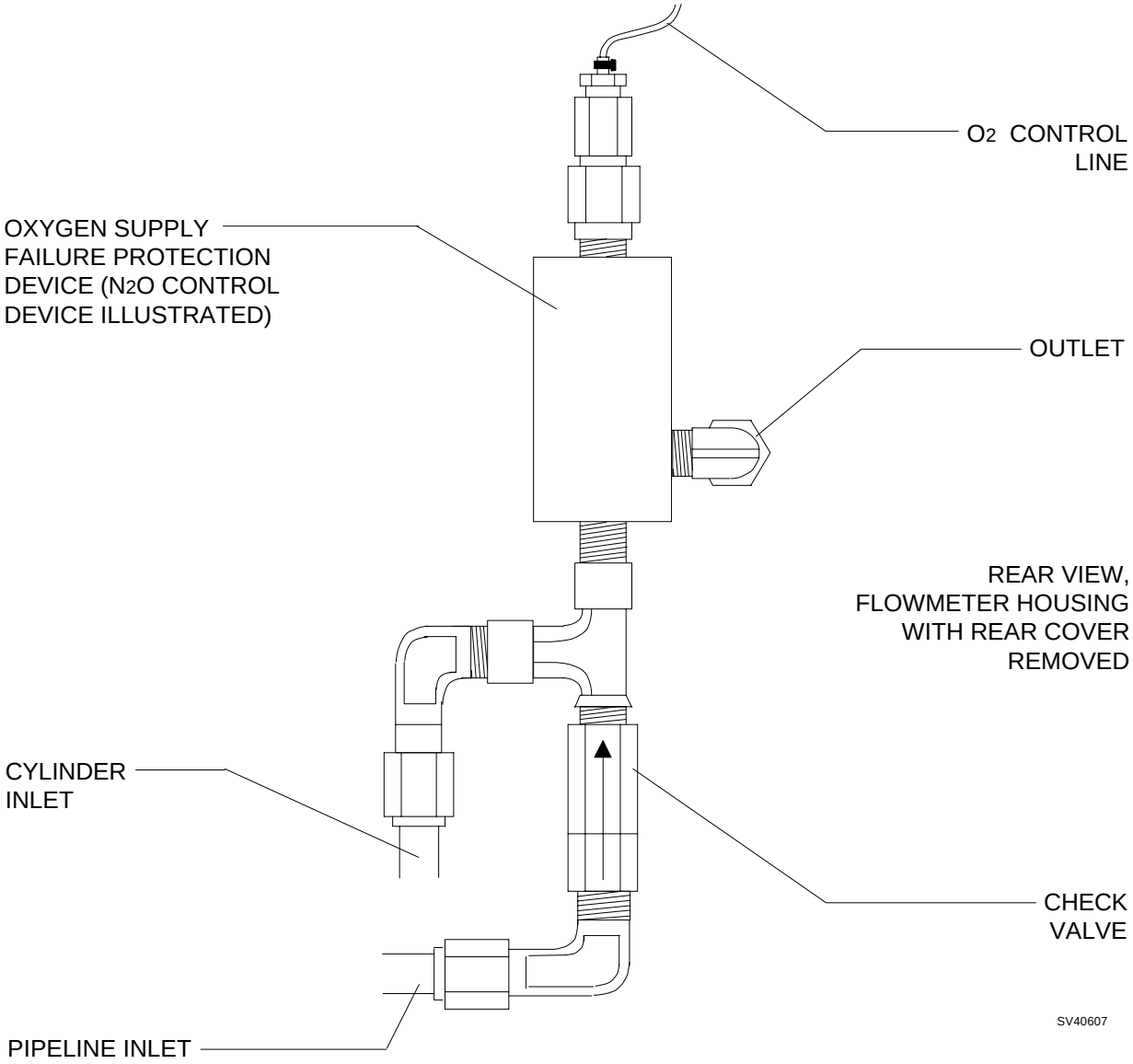


Figure 4-7: OXYGEN SUPPLY FAILURE PROTECTION DEVICE

4.7.12 Perform the following test:

4.7.12.1 Open the cylinder valves.

4.7.12.2 Set the System Power switch to ON.

4.7.12.3 Set the oxygen flow to five liters per minute.

4.7.12.4 Set the other gas flow to five liters per minute.

4.7.12.5 Close the oxygen cylinder valve.

4.7.12.6 As the oxygen flow decreases, the other gas flow should also decrease proportionally.

4.7.12.7 Set the System Power switch to STANDBY.

4.7.13 Replace the rear cover and its retaining screws.

4.7.14 Connect the pipeline hoses.

4.7.15 Perform the PMS Procedure given in Section 6.

4.8 Oxygen Supply Pressure Alarm Switch

The oxygen supply pressure alarm switch is located behind the gas instrumentation panel. Access to the switch requires removal of the rear cover. The replacement switch must be tested to ensure that its operating point is set correctly. Figure 4-8 shows the switch assembly and the location of its adjustment.

4.8.1 Disconnect all pipeline hoses and set the System Power switch to ON.

4.8.2 Close all cylinder valves except the O_2 valve.

4.8.3 Set the oxygen flow to 5 liters per min.

4.8.4 Open the other gas flow control valves to drain pressure from the system.

4.8.5 Close the O_2 cylinder valve and the O_2 flow control valve. Press the O_2 Flush valve to drain oxygen pressure from the system.

4.8.6 Set the System Power switch to STANDBY.

4.8.7 Remove the screws holding the rear cover, and remove the cover.

4.8.8 Disconnect the two compression fittings at the TEE.

4.8.9 Note the position of the wires on the switch so that the replacement unit can be connected in the same manner. Disconnect the wires from the switch and remove the assembly.

4.8.10 Connect the wires to the replacement assembly; connect and tighten the compression fittings on the O_2 lines.

4.8.11 Remove the screws holding the table top to the machine and lift out the table top.

4.8.12 Pull the writing or keyboard tray out to its fully extended position.

4.8.13 Locate the TEE fitting in the ¼ in. diameter output line of the O_2 regulator and remove the plug from the TEE fitting.

4.8.14 Connect a test gauge to the TEE fitting.

4.8.15 Open the oxygen cylinder valve and set the System Power switch to ON.

REAR VIEW, FLOWMETER HOUSING
WITH REAR COVER REMOVED

SV40608

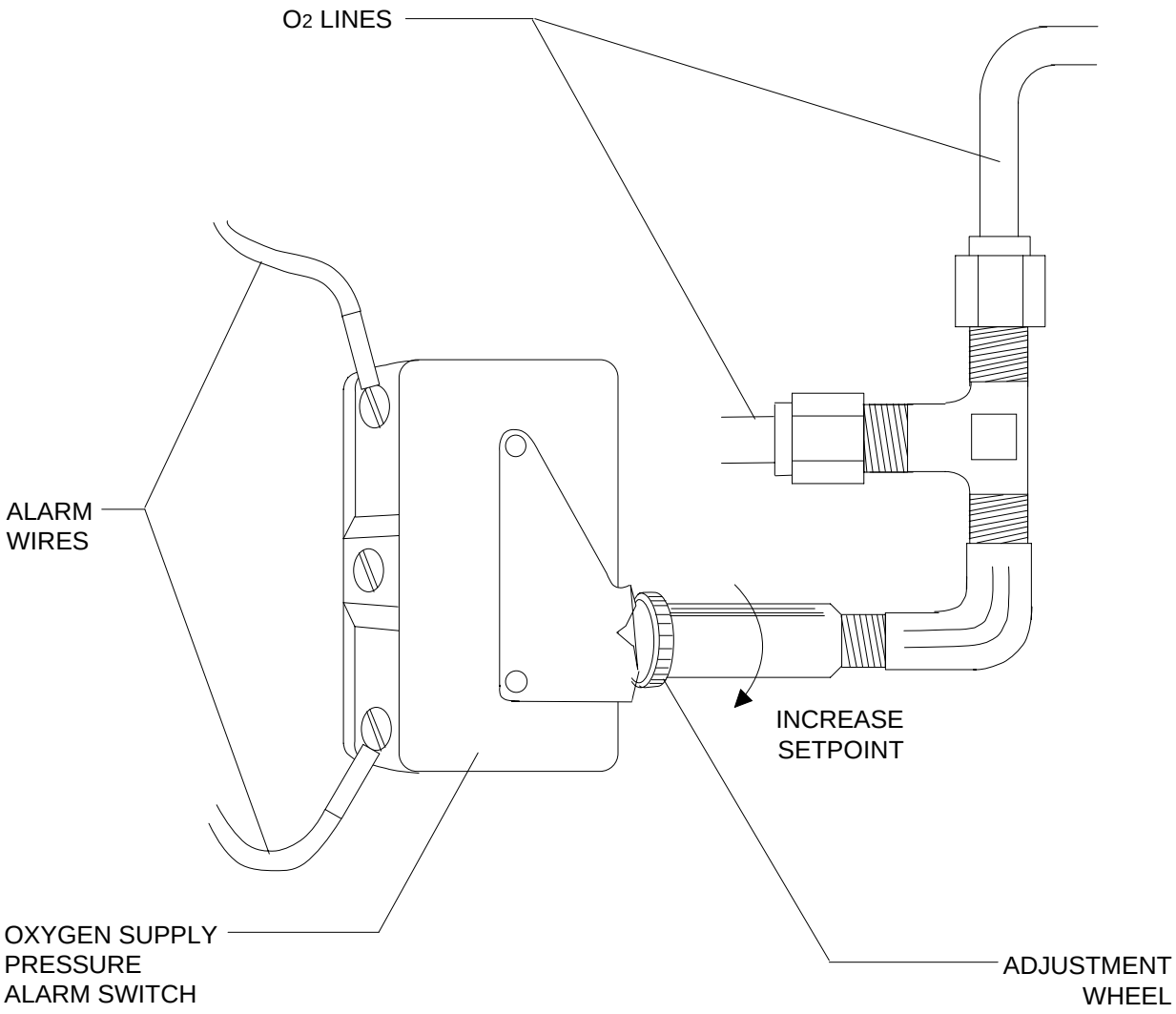


Figure 4-8: OXYGEN SUPPLY PRESSURE ALARM SWITCH

4.8.16 Set the oxygen flow to five liters per minute.

4.8.17 Close the oxygen cylinder valve.

4.8.18 As the pressure drops, the O_2 SUPPLY alarm should activate when the pressure is between 40 and 34 psi as shown on the test gauge.

4.8.19 If the alarm activates when the pressure is below 34 psi, turn the adjustment wheel counter-clockwise, repeat the test and adjust as necessary to bring the set point into the correct range.

If the alarm activates when the pressure is above 40 psi, turn the adjustment wheel clockwise,repeat the test and adjust as necessary to bring the set point into the correct range.

4.8.20 Set the System Power switch to STANDBY.

4.8.21 Disconnect the test gauge and replace the plug in the regulator line TEE fitting.

4.8.22 Replace the table top and its retaining screws.

4.8.23 Replace the rear cover and its retaining screws.

4.8.24 Connect the pipeline hoses.

4.8.25 Perform the PMS Procedure given in Section 6.

4.9 Oxygen Supply Pressure Alarm Whistle (Canada)

The oxygen supply pressure alarm whistle is located inside the flowmeter housing. Access to the whistle assembly requires removal of the flowmeter housing rear cover. Figure 4-9 shows the arrangement of the whistle assembly within the flowmeter housing, and indicates the compression fittings that need to be disconnected in order to remove the assembly.

4.9.1 Set the System Power switch to STANDBY, and remove AC power from the machine.

4.9.2 Close all cylinder valves and disconnect the pipeline hoses.

4.9.3 Press the O_2 FLUSH button to remove pressure from the oxygen circuit.

4.9.4 Remove the screws holding the flowmeter housing rear cover, and remove the cover.

4.9.5 Disconnect the three compression fittings at the locations shown in the illustration, and remove the whistle assembly.

4.9.6 Position the replacement whistle assembly in the flowmeter housing, connect and tighten the three compression fittings.

4.9.7 Replace the flowmeter housing rear cover and its retaining screws.

4.9.8 Connect the pipeline hoses and perform the following test:

-- Set the System Power switch to ON.

-- Set the oxygen flow rate to 1 l/min.

-- Close the pipeline supply valve and observe the pipeline pressure gauge.

-- The alarm whistle shall sound for a minimum of 10 seconds when the pressure drops below the range of 35 to 30 PSI.

4.9.9 Perform the PMS Procedure given in Section 6.

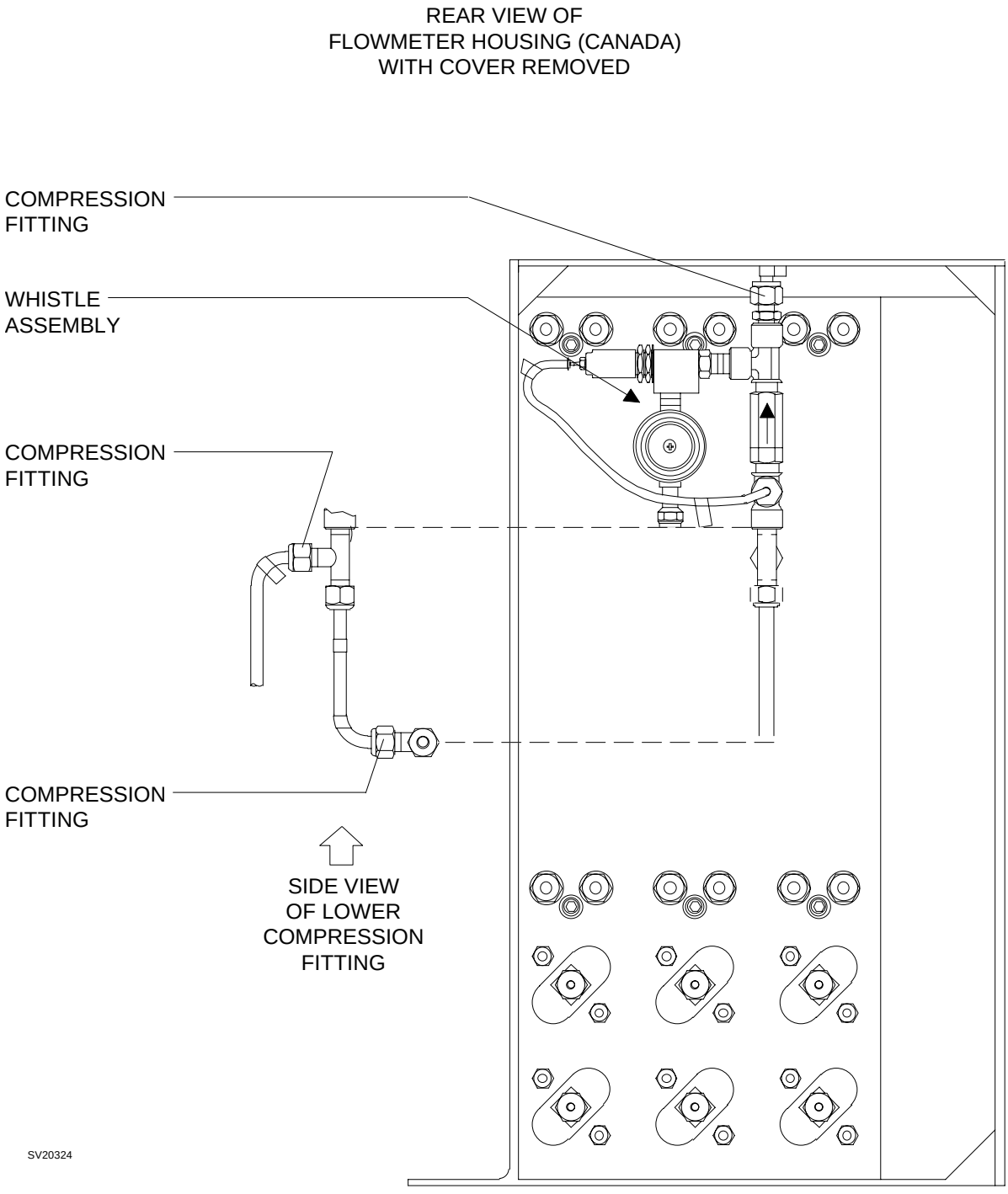


Figure 4-9: OXYGEN SUPPLY PRESSURE ALARM WHISTLE (CANADA)

4.10 Oxygen Ratio Monitor/Controller

The oxygen ratio monitor/controller (ORMC) is located in the vapor box and is accessible by removing the rear cover panel above the vaporizer mounts. Figure 4-10 shows the location of the ORMC mounting screws and connections. Test and adjustment instructions are included in the following procedure.

NOTE: Steps marked with an asterisk (*) do not apply to later model machines that do not have the O_2/N_2O ratio lamp on the alarm channel.

4.10.1 Disconnect all pipeline hoses and set the System Power switch to ON.

4.10.2 Close all cylinder valves except the O_2 valve.

4.10.3 Set the oxygen flow to 5 liters per min.

4.10.4 Open the other gas flow control valves to drain pressure from the system.

4.10.5 Close the O_2 cylinder valve and the O_2 flow control valve. Press the O_2 Flush valve to drain oxygen pressure from the system.

4.10.6 Set the System Power switch to STANDBY.

4.10.7 Remove the four screws holding the vapor box rear cover, and remove the cover.

4.10.8 Remove the two screws holding the ORMC to the bottom of the vapor box.

4.10.9 Remove the four screws holding the bottom plate of the vapor box, and remove the plate to gain access to the ORMC connections.

4.10.10 Disconnect the flexible O_2 tubing from the left side of the ORMC, and disconnect the flexible N_2O tubing from the right side of the MPL switch. (Later models do not have the MPL switch.)

* 4.10.11 Cut the tie-wrap clamp on the in-line wiring harness connectors, and separate the two ORMC connections.

4.10.12 While holding the ORMC, carefully disconnect the compression fittings on the N_2O lines.

4.10.13 Disconnect the remaining flexible N_2O tubing from the tee fitting at the front of the ORMC. (Later models do not have the tee fitting.)

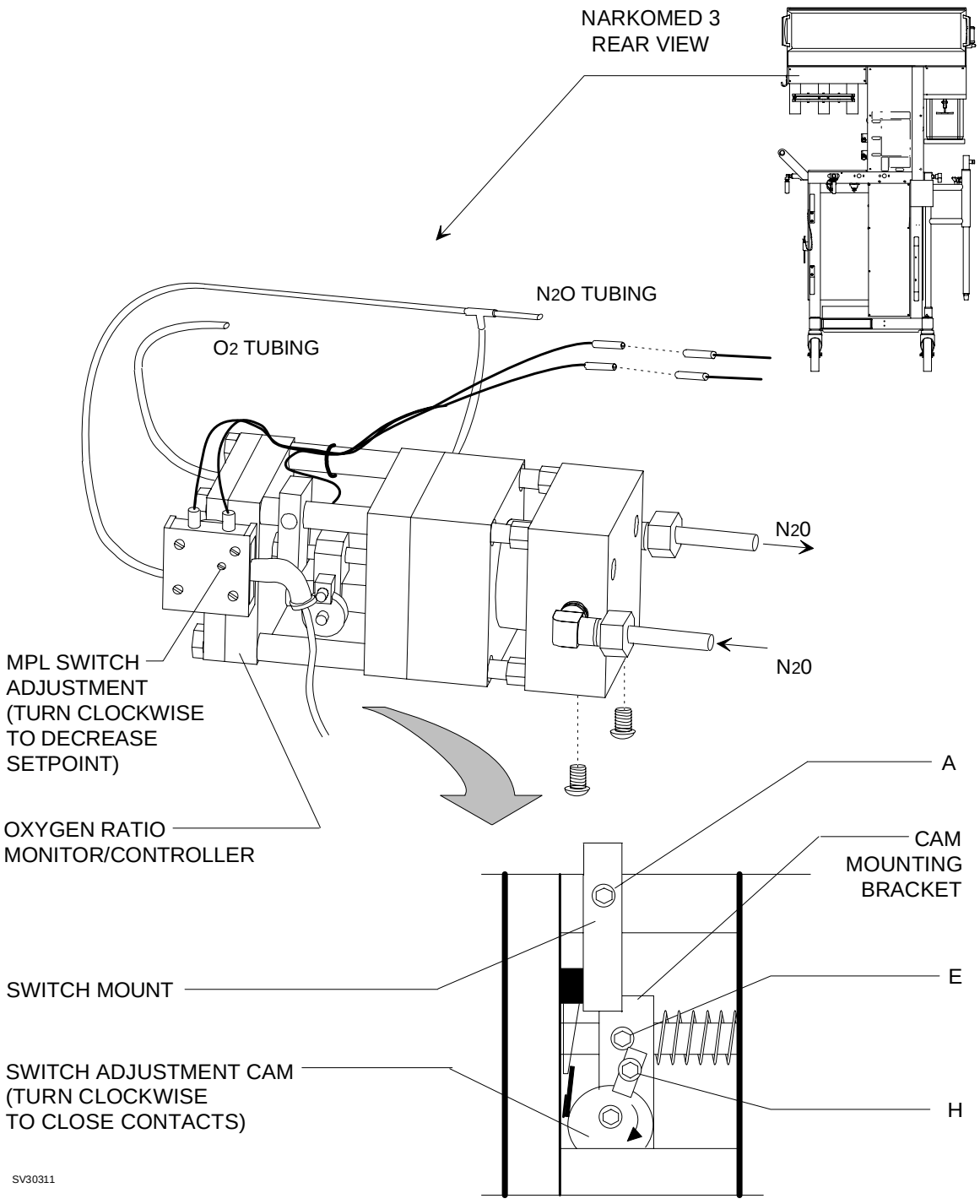


Figure 4-10: OXYGEN RATIO MONITOR/CONTROLLER

4.10.14 Connect the flexible N_2O tubing that was removed in the previous step to the tee fitting at the front of the replacement ORMC, and secure the connection with a new tie strap clamp. (Later models do not have the tee fitting.)

4.10.15 Connect the copper N_2O lines to the replacement ORMC and tighten the compression fittings.

* 4.10.16 Join the in-line wiring harness to the replacement ORMC connectors and install a new tie-wrap cable clamp.

4.10.17 Connect the flexible O_2 tubing to the left side of the ORMC, and connect the flexible N_2O tubing to right side of the MPL switch. Secure each connection with a press-on clamp. (Later models do not have the MPL switch.)

4.10.18 Open the O_2 and N_2O cylinder valves.

4.10.19 Set the System Power switch to ON, and perform the following test:

4.10.19.1 Open the N_2O flow control valve three turns. There should be no nitrous oxide flow.

4.10.19.2 Slowly open the O_2 flow control valve. The nitrous oxide should start to flow when the oxygen flow is between 200 and 300 ml per minute.

4.10.19.3 Connect a calibrated oxygen monitor to the Freshgas Outlet.

4.10.19.4 Adjust the oxygen flow to 1 liter per minute. The oxygen concentration should be between 21% and 29% oxygen.

* 4.10.19.5 The yellow O_2/N_2O FLOW RATIO lamp on the alarm panel should be lighted.

4.10.19.6 Adjust the oxygen flow to 1.5 liters per minute. The oxygen concentration should be between 21% and 29% oxygen.

* 4.10.19.7 The yellow O_2/N_2O FLOW RATIO lamp on the alarm panel should be lighted.

4.10.19.8 Adjust the oxygen flow to a point where the nitrous oxide flowmeter indicates 10 liters per minute.

* 4.10.19.9 The yellow O_2/N_2O FLOW RATIO lamp on the alarm panel should be lighted.

4.10.19.10 Close the oxygen flow control valve. The nitrous oxide flow should decrease proportionally, and the oxygen concentration should remain between 21% and 29% oxygen.

4.10.19.11 The nitrous oxide flow should stop when the flow of oxygen is between 200 and 300 ml per minute.

4.10.19.12 Close the N_2O flow control valve and set the System Power switch to STANDBY.

NOTE: If the ORMC is not working properly, skip to the adjustment procedure beginning in Paragraph 4.10.24.

4.10.20 Replace the bottom plate of the vapor box. Be sure it is oriented correctly with the ORMC mounting holes in the correct position.

4.10.21 Secure the ORMC to the bottom of the vapor box with its two mounting screws.

4.10.22 Replace the rear cover of the vapor box.

4.10.23 Perform the PMS Procedure given in Section 6.

4.10.24 Following is the adjustment procedure for the ORMC:

4.10.24.1 Disconnect the pipeline hoses.

4.10.24.2 Open the oxygen and nitrous oxide cylinder valves.

4.10.24.3 Set the System Power switch to ON.

4.10.24.4 Close the O_2 flow control valve.

4.10.24.5 Open the N_2O flow control valve to its counter-clockwise stop.

4.10.24.6 If there is no nitrous oxide flow, proceed to Step 4.10.24.8.

4.10.24.7 If there is nitrous oxide flow, loosen set screw E and move the cam mounting bracket to the right until the nitrous oxide flow stops. Tighten set screw E.

4.10.24.8 Slowly open the O_2 flow control valve.

4.10.24.9 If the nitrous oxide starts to flow when the oxygen flow is between 200 and 300 ml per minute, proceed to step 4.10.24.12.

4.10.24.10 If the nitrous oxide does not start to flow when the oxygen flow is between 200 and 300 ml per minute, loosen set screw E and move the cam mounting bracket to the left until nitrous oxide flow starts. Tighten set screw E.

4.10.24.11 Repeat steps 4.10.24.4 through 4.10.24.10 until no further adjustment of the cam mounting bracket is needed.

4.10.24.12 Adjust the oxygen flow to a point where the nitrous oxide flowmeter indicates 10 liters per minute.

4.10.24.13 The oxygen concentration should be between 21% and 29% oxygen.

* 4.10.24.14 If the yellow O_2 /N_2O FLOW RATIO lamp on the alarm panel is lighted, proceed to step 18.

* 4.10.24.15 If the yellow O_2 /N_2O FLOW RATIO lamp on the alarm panel is not lighted, loosen set screw H and turn the switch adjustment cam until it is pointing downward.

* 4.10.24.16 Loosen set screw A and move the switch mount until it is nearly touching the switch adjustment cam. Tighten setscrew A.

* 4.10.24.17 Turn the cam clockwise until the switch contacts close and the O_2/N_2O FLOW RATIO lamp is lighted. Tighten set screw H.

* 4.10.24.18 Close the N_2O flow control valve.

* 4.10.24.19 Adjust the oxygen flow to 1 liter per minute.

* 4.10.24.20 Slowly open the N_2O flow control valve.

* 4.10.24.21 The yellow O_2/N_2O FLOW RATIO lamp on the alarm panel should light as soon as the ORMC limits the flow of nitrous oxide.

* 4.10.24.22 Adjust the oxygen flow to 1.5 liters per minute.

* 4.10.24.23 Slowly open the N_2O flow control valve.

* 4.10.24.24 The yellow O_2/N_2O FLOW RATIO lamp on the alarm panel should light as soon as the ORMC limits the flow of nitrous oxide.

4.10.24.25 Adjust the oxygen flow to 2 liters per minute.

4.10.24.26 Slowly open the N_2O flow control valve.

* 4.10.24.27 The yellow O_2/N_2O FLOW RATIO lamp on the alarm panel should light as soon as the ORMC limits the flow of nitrous oxide.

4.10.24.28 Close the oxygen flow control valve. The nitrous oxide flow should decrease proportionally, and the oxygen concentration should remain between 21% and 29% oxygen.

4.10.24.29 The nitrous oxide flow should stop when the flow of oxygen is between 200 and 300 ml per minute.

* 4.10.24.30 If the O_2/N_2O FLOW RATIO lamp turns off when the nitrous oxide flow drops to between 100 and 200 ml per minute, proceed to Step 4.10.24.32.

* 4.10.24.31 If the O_2/N_2O FLOW RATIO lamp does not turn off when the nitrous oxide flow drops to between 100 and 200 ml per minute, adjust the MPL switch until the O_2/N_2O FLOW RATIO lamp turns off.

4.10.24.32 Close all cylinder valves except the O_2 valve.

4.10.24.33 Set the oxygen flow to 5 liters per min.

4.10.24.34 Open the other gas flow control valves to drain pressure from the system.

4.10.24.35 Close the O_2 cylinder valve and the O_2 flow control valve. Press the O_2 Flush valve to drain oxygen pressure from the system.

4.10.24.36 Close the N_2O flow control valve.

4.10.24.37 Reconnect the pipeline hoses.

4.10.24.38 Replace the rear cover of the vapor box.

4.10.24.39 Perform the PMS Procedure given in Section 6.

4.11 Vaporizers

Each vaporizer is held to the machine by two metric sized hex screws. These screws are accessible at the back of the vaporizer mount, below the interlock mechanism as shown in Figure 4-11. Before removing a vaporizer from the machine, it must be completely drained and dried in accordance with the procedure given below. Be sure to have a suitable packing or storage container available in which to place the vaporizer.

CAUTION: The following steps must be performed in the sequence given.

4.11.1 Set the System Power switch to ON.

4.11.2 Set all vaporizer handwheels to their Zero or OFF position.

WARNING: Do not inhale anesthetic vapors as this could result in personal injury.

4.11.3 Remove the filler and drain plugs, and drain the vaporizer into a suitable container. Dispose of the residual agent in an approved manner.

4.11.4 Turn the vaporizer handwheel to the maximum concentration setting.

4.11.5 Set the oxygen flow to 10 l/min. for at least 20 minutes.

WARNING: This procedure must be performed in a well ventilated area and without personnel present.

4.11.6 Turn the vaporizer handwheel to 0 (zero), and replace the filler and drain plugs.

4.11.7 Turn the oxygen flow off, and set the System Power switch to STANDBY.

4.11.8 While holding the vaporizer, remove the mounting screws and carefully separate the vaporizer from the machine. Note the arrangement of gaskets so that the replacement vaporizer can be installed in the same manner.

4.11.9 Place the vaporizer in a suitable container for transport or storage.

WARNING: Do not tilt a vaporizer that contains anesthetic agent more than 45 degrees. Failure to observe this precaution will render the handwheel calibration invalid.

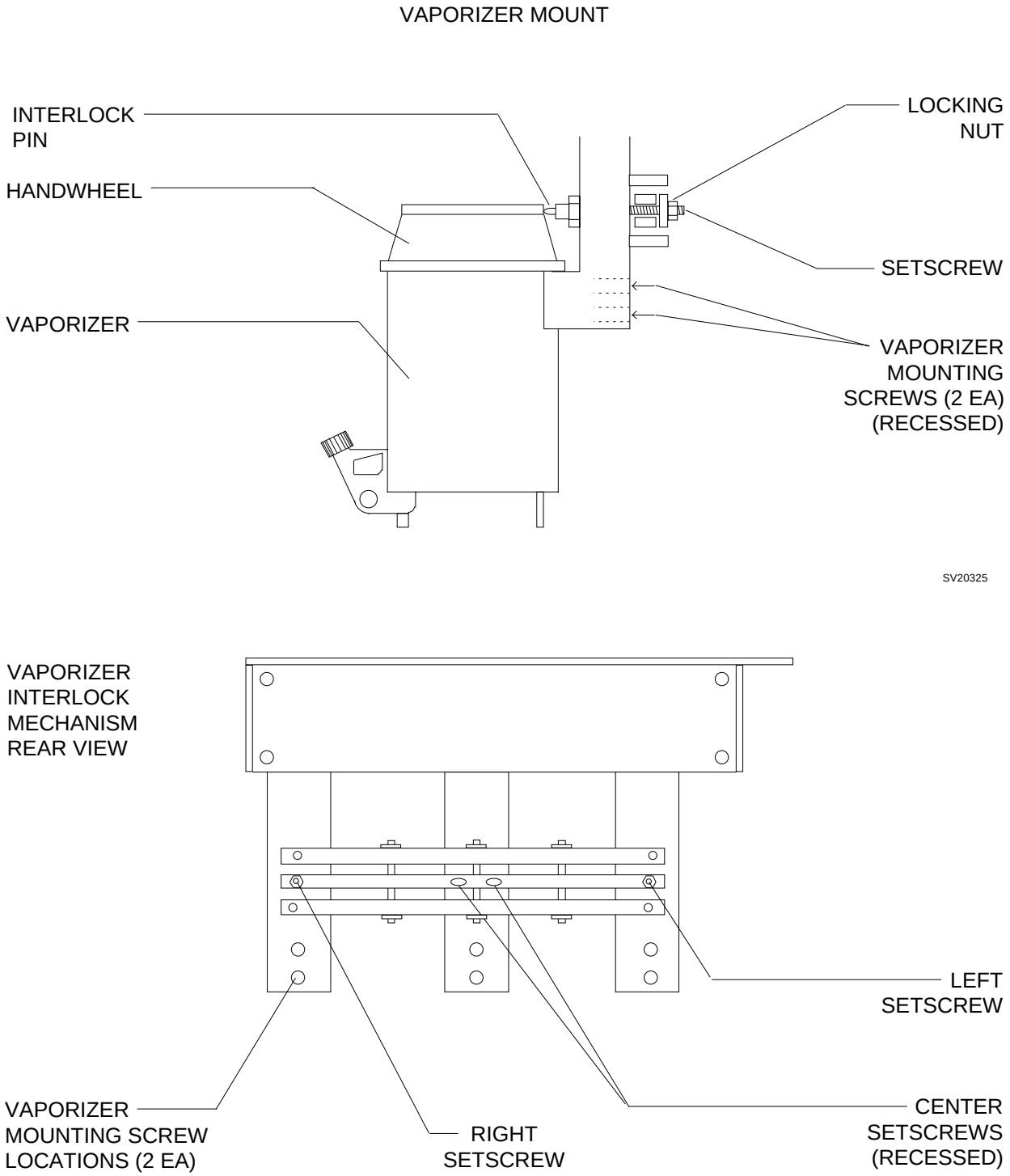


Figure 4-11: VAPORIZER INSTALLATION AND INTERLOCK ADJUSTMENT

NOTE: Should a vaporizer containing anesthetic agent be accidentally tilted more than 45 degrees, it must be drained and flushed in accordance with instructions given in the manual supplied with the vaporizer.

4.11.10 Set the handwheel on the replacement vaporizer to its Zero position.

4.11.11 Install the replacement vaporizer on the machine (be sure the O-rings are in place) and tighten the mounting screws to a torque of 24 to 26.5 inch pounds.

4.11.12 Perform the following test on the interlock mechanism and make any necessary adjustments:

4.11.12.1 Turn the center vaporizer handwheel ON. The left and the right vaporizer handwheels should be locked in their Zero position. If the left or right vaporizer does not lock, tighten the corresponding center set screw until the handwheel locks properly.

4.11.12.2 Turn the center vaporizer OFF and turn the left vaporizer ON. The center and the right vaporizer handwheels should be locked in their Zero position. If the right vaporizer does not lock, loosen the locking nut on the right set screw and adjust the set screw until the handwheel locks properly. Tighten the locking nut while holding the set screw to maintain the correct adjustment.

NOTE: Do not over-tighten the set screws. Each vaporizer handwheel must turn easily while the other vaporizers are locked .

4.11.12.3 Turn the left vaporizer OFF and turn the right vaporizer ON. The center and the left vaporizer handwheels should be locked in their Zero position. If the left vaporizer does not lock, loosen the locking nut on the left set screw and adjust the set screw until the handwheel locks properly. Tighten the locking nut while holding the set screw to maintain the correct adjustment.

4.11.13 Perform the PMS Procedure given in Section 6.

4.12 O2 Flush Valve

The O_2 flush valve is located at the front of the machine next to the freshgas outlet. Access to the flush valve requires removal of the table top. Figure 4-12 shows the mounting and assembly details of the flush valve.

4.12.1 Set the System Power switch to STANDBY.

4.12.2 Disconnect all pipeline hoses.

4.12.3 Close the O_2 cylinder valve.

4.12.4 Press the O_2 Flush valve to drain oxygen pressure from the system.

4.12.5 Remove the screws holding the table top to the machine and lift out the table top.

4.12.6 Hold the O_2 Flush button in and rotate it until one of its set screws are visible through the access hole in the guard ring, and loosen the set screw.

4.12.7 Turn the O_2 Flush button 180 degrees, hold it in and loosen the other set screw.

4.12.8 Remove the O_2 Flush button and washer from the valve shaft.

4.12.9 Disconnect the two compression fittings at the valve.

NOTE: Do not lose the flow restrictor located at the right-angle fitting. This restrictor will be transferred to the replacement valve assembly.

4.12.10 The O_2 Flush valve is retained by the guard ring on the front of the machine frame. Hold the body of the Clippard valve with an open end wrench; insert a rod or hex wrench through the holes in the guard ring (or use a spanner wrench), and un-screw the guard ring from the front of the frame rail.

4.12.11 Assemble the replacement O_2 Flush valve, spacer, internal tooth lock washer and guard ring through the frame and tighten the assembly, making sure that the valve is mounted straight.

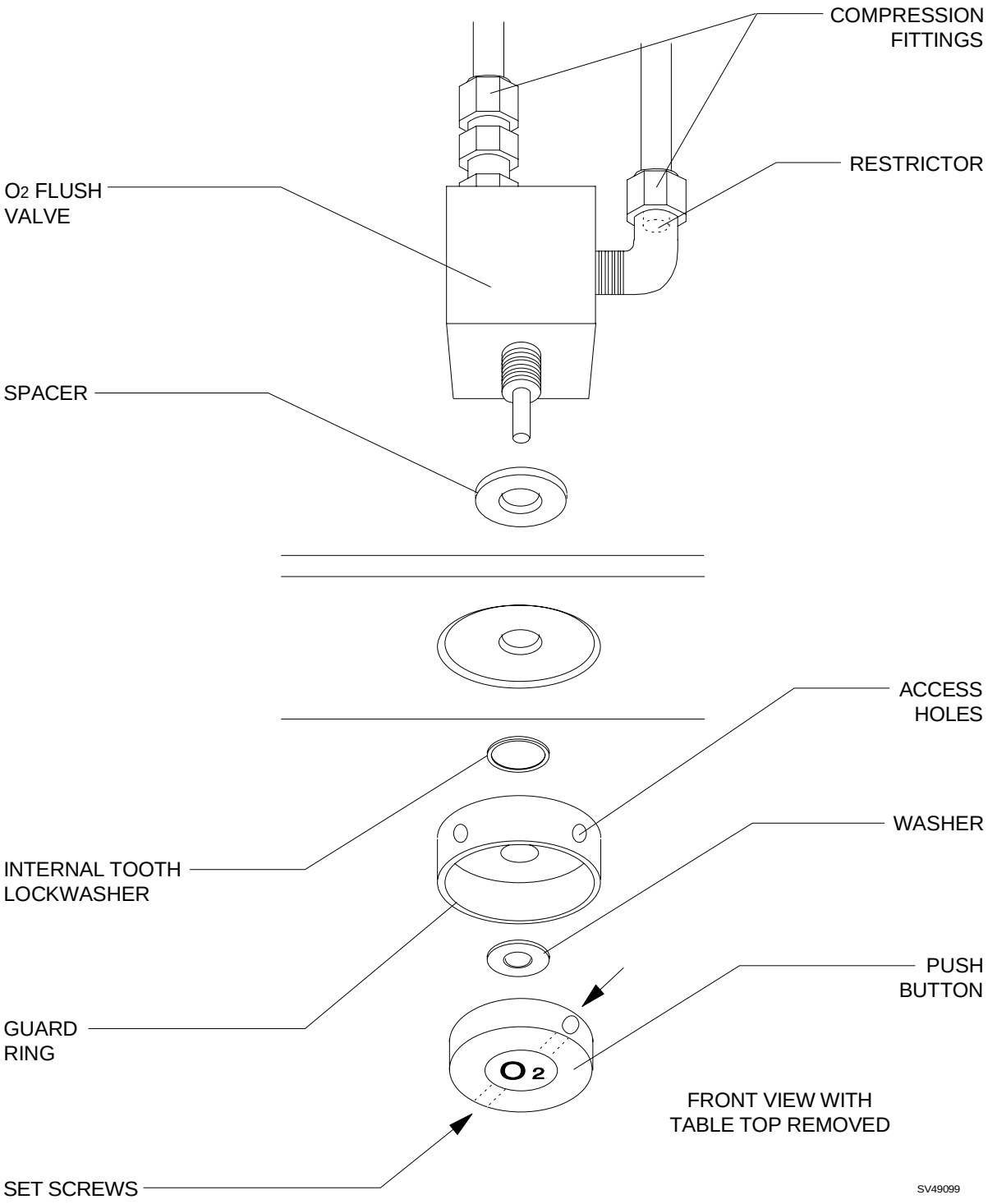


Figure 4-12: O_2 FLUSH VALVE

4.12.12 Connect the compression fittings to the valve. Be sure the flow restrictor is in place at the right-angle fitting.

4.12.13 Place the washer and the O_2 Flush button on the valve shaft.

4.12.14 Hold the O_2 Flush button in and turn it until a set screw is visible through an access hole in the guard ring. Tighten the set screw. Rotate the button 180 degrees until the other set screw is visible, and tighten the set screw.

4.12.15 Disconnect the absorber freshgas hose from the freshgas outlet. Connect a test gauge and B.P. bulb to the freshgas outlet, and perform the following test:

4.12.15.1 Open the oxygen cylinder valve.

4.12.15.2 Release any pressure that is indicated on the test gauge.

4.12.15.3 Over the next 60 seconds, the test gauge should not show a pressure increase greater than 2 cm H_2O.

4.12.15.4 Increase the pressure to 50 cm H_2O.

4.12.15.5 The pressure should not drop more than 10 cm H_2O in the next 30 seconds.

4.12.15.6 Disconnect the test gauge from the freshgas outlet.

4.12.15.7 Open the oxygen cylinder valve and allow the pressure to stabilize. (The cylinder pressure must be at least 1000 psi for this test.)

4.12.15.8 Close the oxygen cylinder valve.

4.12.15.9 The pressure should not drop more than 50 psi in two minutes.

4.12.15.10 Connect a volumeter to the freshgas outlet, and reset the volumeter to zero.

4.12.15.11 Press the O_2 Flush button and observe the flow rate. It should be between 45 and 65 liters per minute.

4.12.15.12 Disconnect the volumeter from the freshgas outlet.

4.12.16 Connect the absorber freshgas hose to the freshgas outlet.

4.12.17 Replace the table top and secure it with the mounting screws.

4.12.18 Connect the pipeline hoses.

4.12.19 Perform the PMS Procedure given in Section 6.

4.13 Ventilator Controller Assembly

The ventilator controller assembly is located in the left side of the ventilator box. Access to the controller requires removing the front panel from the ventilator box. Figure 4-13 shows the mounting screw locations and cable connections to the ventilator controller.

4.13.1 Set the System Power switch to STANDBY.

4.13.2 Remove the four screws holding the ventilator box front panel. Remove the panel and carefully separate the ventilator switch in-line connector.

4.13.3 Remove the two screws holding the ventilator controller assembly to the floor of the ventilator box.

4.13.4 Pull the controller assembly forward and disconnect the two cables from J1 and J2 at the back of the assembly, and remove the controller assembly.

4.13.5 Plug the cables that were previously removed into J1 and J2 on the back of the replacement controller assembly.

VENTILATOR BOX TOP VIEW

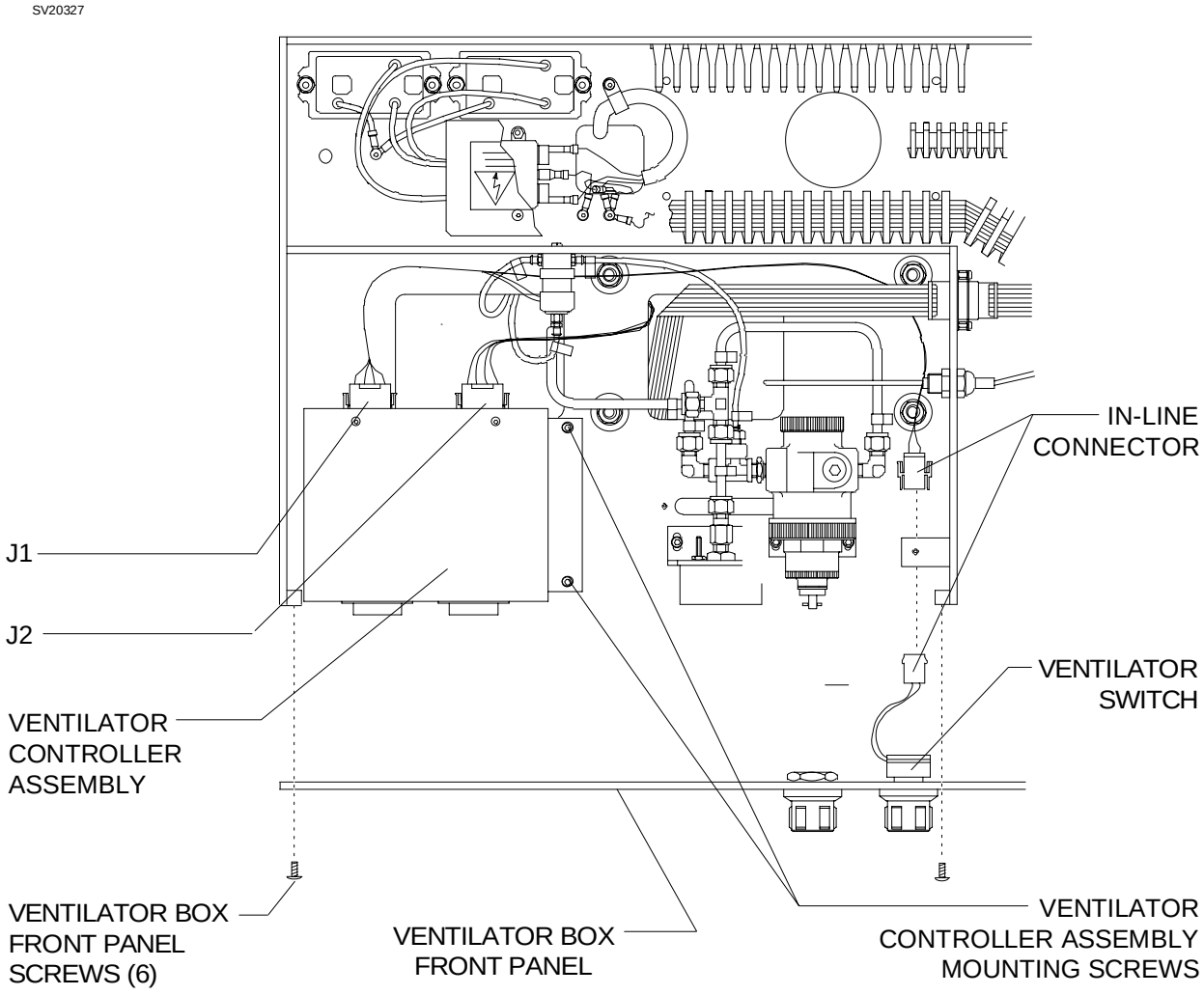


Figure 4-13: VENTILATOR CONTROLLER ASSEMBLY

4.13.6 Mount the replacement controller assembly to the floor of the ventilator box and secure it with the two mounting screws.

4.13.7 Join the ventilator switch in-line connector, and replace the front panel of the ventilator box.

4.13.8 Perform the PMS Procedure given in Section 6.

4.14 Ventilator Solenoid Valve

The ventilator solenoid valve is located in the ventilator box and is mounted on the inner back wall of the box. Replacement of the solenoid valve requires lifting the monitor box to gain access to its mounting and connections. Figure 4-14 shows the mounting location, electrical connections and tubing arrangement of the solenoid valve.

4.14.1 Set the System Power switch to STANDBY and remove AC power from the machine.

4.14.2 Remove the screws holding the monitor box to the ventilator box.

WARNING: Two people are required to perform the remaining portion of this procedure.

4.14.3 Raise the rear left side of the monitor box chassis approximately two inches, and prop the box open.

WARNING: Ensure that AC power is removed from the machine before raising the monitor box. Failure to observe this precaution may cause injury by electric shock.

4.14.4 Remove the two screws holding the safety cover over the AC power filter, and remove the cover.

4.14.5 Remove the two screws holding the solenoid valve to the inner wall of the ventilator box.

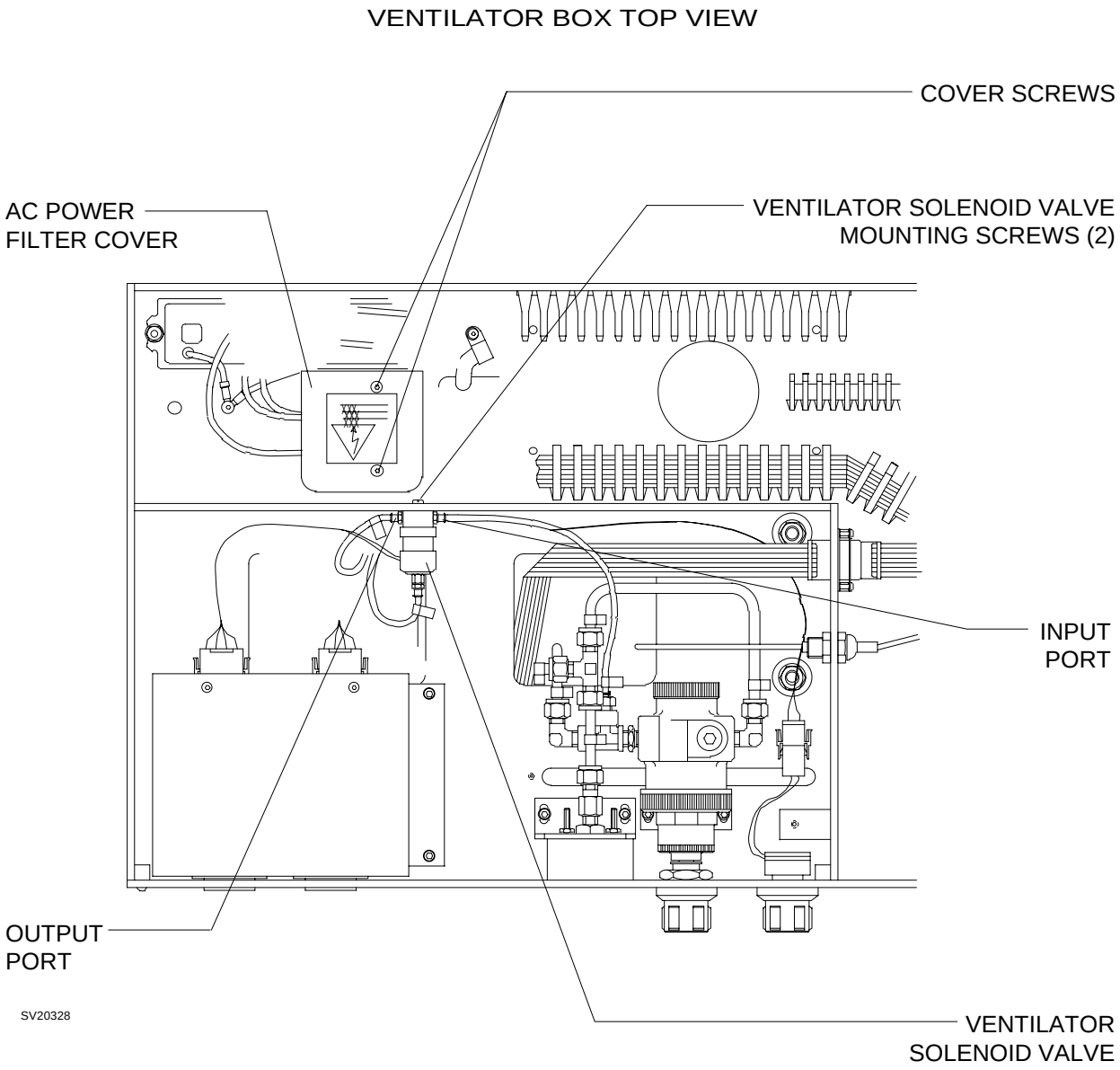


Figure 4-14: VENTILATOR SOLENOID VALVE

4.14.6 Remove the prop from the rear left side of the monitor box, and return the box to its normal position.

4.14.7 Raise the front of the monitor box approximately four inches, and prop the box open.

4.14.8 Pull the solenoid valve forward to gain access to its connections, and remove the electrical connections.

4.14.9 Remove the three flexible tubing connections and remove the solenoid valve. Mark each tube so that the replacement solenoid can be connected in the same manner.

4.14.10 Connect the flexible tubing to the replacement solenoid valve.

4.14.11 Connect the two wires to the solenoid, and place the solenoid near its mounting position.

4.14.12 Remove the prop from the front of the monitor box and lower the box to its original position.

4.14.13 Raise the rear of the monitor box chassis approximately two inches, and prop the box open.

4.14.14 Mount the solenoid valve to the ventilator box using the original hardware.

4.14.15 Replace the safety cover over the AC power filter and secure it with the two screws.

4.14.16 Remove the prop from the rear of the monitor box, and return the box to its normal position.

4.14.17 Replace the screws holding the monitor box to the ventilator box.

4.14.18 Restore power to the machine and perform the PMS Procedure given in Section 6.

4.15 Convenience Outlet AC Power Filter

The convenience outlet AC power filter is located in the back of the ventilator box near the AC convenience outlets. Access to the power filter requires lifting the monitor box. Figure 4-15 shows the location of the filter, its connections and its mounting arrangement.

4.15.1 Set the System Power switch to STANDBY and remove AC power from the machine.

4.15.2 Remove the screws holding the monitor box to the ventilator box.

WARNING: Two people are required to perform the remaining portion of this procedure.

4.15.3 Raise the rear of the monitor box chassis approximately two inches, and prop the box open.

WARNING: Ensure that AC power is removed from the machine before raising the monitor box. Failure to observe this precaution may cause injury by electric shock.

4.15.4 Remove the two screws holding the safety cover over the AC power filter, and remove the cover.

4.15.5 Disconnect the AC wiring from each side of the filter. Note the position of the wires so they can be re-installed in the same manner.

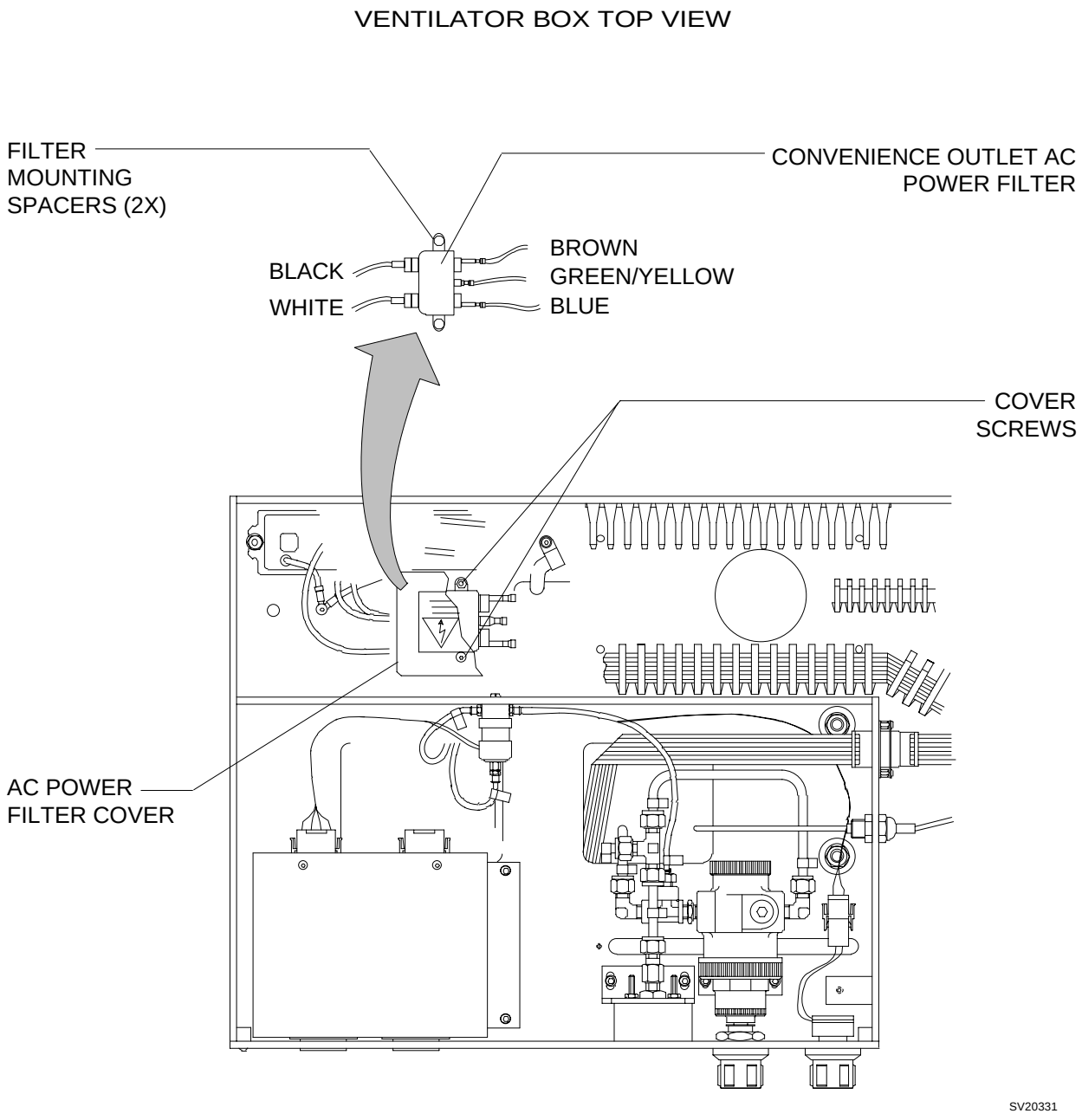


Figure 4-15: CONVENIENCE OUTLET AC POWER FILTER

4.15.6 Unscrew the two hex post nuts holding the filter to the ventilator box, and remove the filter.

4.15.7 Install the replacement filter and secure it with the two hex post nuts.

4.15.8 Connect the AC wiring to the replacement filter. Be sure to observe the wire color code as illustrated.

4.15.9 Place the safety cover over the filter and secure it with the two screws.

4.15.10 Remove the prop from the rear of the monitor box, and return the box to its normal position.

4.15.11 Replace the screws holding the monitor box to the ventilator box.

4.15.12 Restore power to the machine and perform the PMS Procedure given in Section 6.

4.16 Inspiratory Flow Regulator

The inspiratory flow regulator is located in the ventilator box. Access to the regulator requires removal of the ventilator box front panel, and lifting the monitor box. Figure 4-16 shows the regulator mounting arrangement and its connections.

4.16.1 Set the System Power switch to STANDBY.

4.16.2 Remove the four screws holding the ventilator box front panel. Remove the panel and carefully separate the ventilator switch in-line connector.

4.16.3 Remove the screws holding the monitor box to the ventilator box.

WARNING: Two people are required to perform the remaining portion of this procedure.

4.16.4 Raise the front of the monitor box chassis approximately four inches, and prop the box open.

WARNING: Ensure that AC power is removed from the machine before raising the monitor box. Failure to observe this precaution may cause injury by electric shock.

4.16.5 Disconnect the two compression fittings at the regulator.

4.16.6 Remove the tie strap securing the small diameter flex tubing to the hose barb on the flow regulator assembly, and disconnect the tubing.

4.16.7 Un-screw the retaining ring holding the regulator to its mounting bracket, and remove the regulator.

4.16.8 Install the replacement regulator in the mounting bracket and tighten the mounting ring.

4.16.9 Connect the two compression fittings to the regulator.

4.16.10 Reattach the small diameter flex tubing previously removed from the regulator assembly and secure the connection with a tie strap.

4.16.11 Remove the prop from the front of the monitor box, and return the box to its normal position.

4.16.12 Replace the four screws holding the monitor box to the ventilator box.

VENTILATOR BOX TOP VIEW

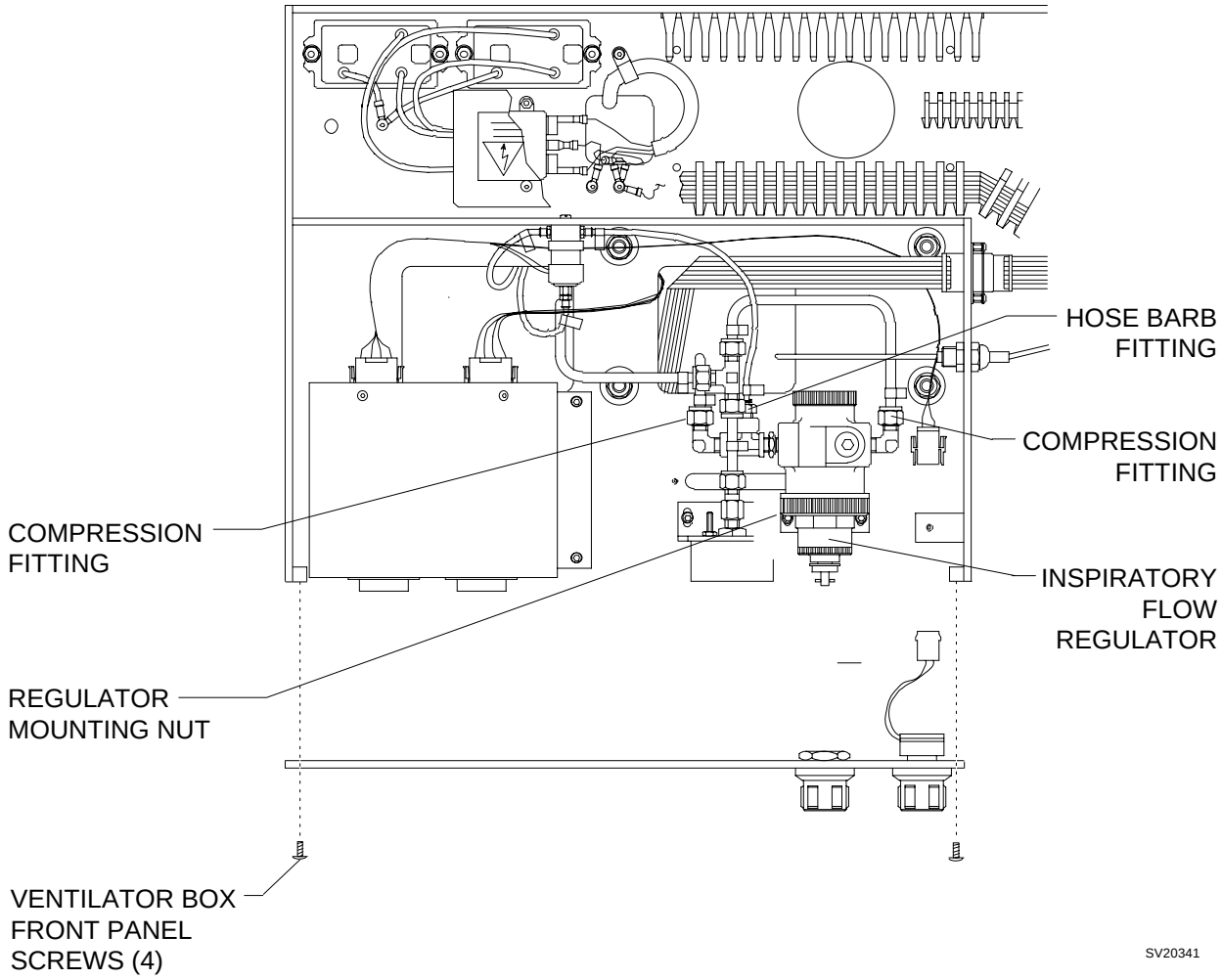


Figure 4-16: INSPIRATORY FLOW REGULATOR

4.16.13 Join the ventilator switch in-line connector, and replace the front panel of the ventilator box.

4.16.14 Perform the PMS Procedure given in Section 6.

4.17 Ventilator Bellows Valve and Guide Assembly

The ventilator bellows valve and guide assembly is located in the bellows box on the left side of the machine. Access to the valve case and guide assembly requires that the bellows box front panel and the bellows canister be removed from the bellows box. The monitor box will also need to be raised for access to a connection inside the ventilator box.

Replacement Procedure 1 applies to machines with a two-piece tidal volume adjustment and valve case assembly inside the bellows box. Figure 4-17 shows the mounting and tubing arrangement.

Replacement Procedure 2 applies to machines with a one-piece tidal volume adjustment and valve case assembly inside the bellows box. Figure 4-17A shows the mounting and tubing arrangement for assemblies with either a Humphrey or a Clippard valve.

Replacement Procedure 1:

4.17.1 Set the System Power switch to STANDBY, remove AC power from the machine, and disable all circuit breakers.

4.17.2 Close all cylinder valves, and disconnect the pipeline hoses from the machine.

4.17.3 Press the O_2 FLUSH button to relieve pressure from the system.

4.17.4 Adjust the TIDAL VOLUME knob to fully extend the volume indicator to its minimum setting.

4.17.5 Disconnect the bellows hose and the scavenger hose from the bellows assembly. Loosen the wingnuts and remove the bellows assembly.

4.17.6 Remove the canister from the bellows box by pulling it downward.

4.17.7 Remove the screws holding the front panel and tidal volume adjustment knob, and remove the panel. The knob assembly remains with the panel. On machines with a two-piece panel, remove the angle plate above the knob panel. (Some older machines may have a non-removable panel above the bellows adjustment knob.)

4.17.8 Remove the four socket head screws securing the valve case assembly to the bellows top plate.

4.17.9 Carefully cut the tie strap at the exhaust port (front of valve) and remove the large hose.

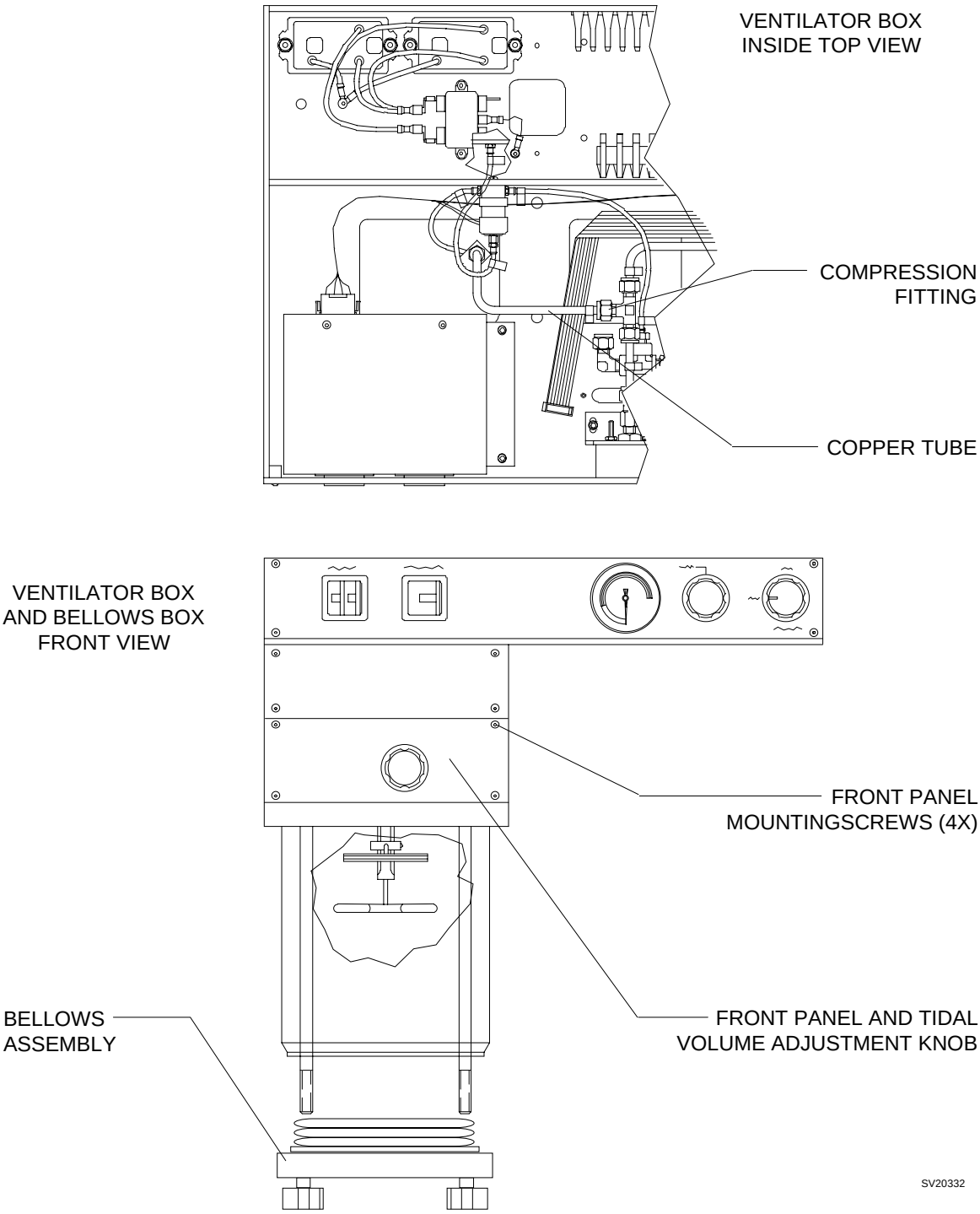


Figure 4-17: TWO-PIECE TIDAL VOLUME ADJ. & VALVE CASE ASSEMBLY

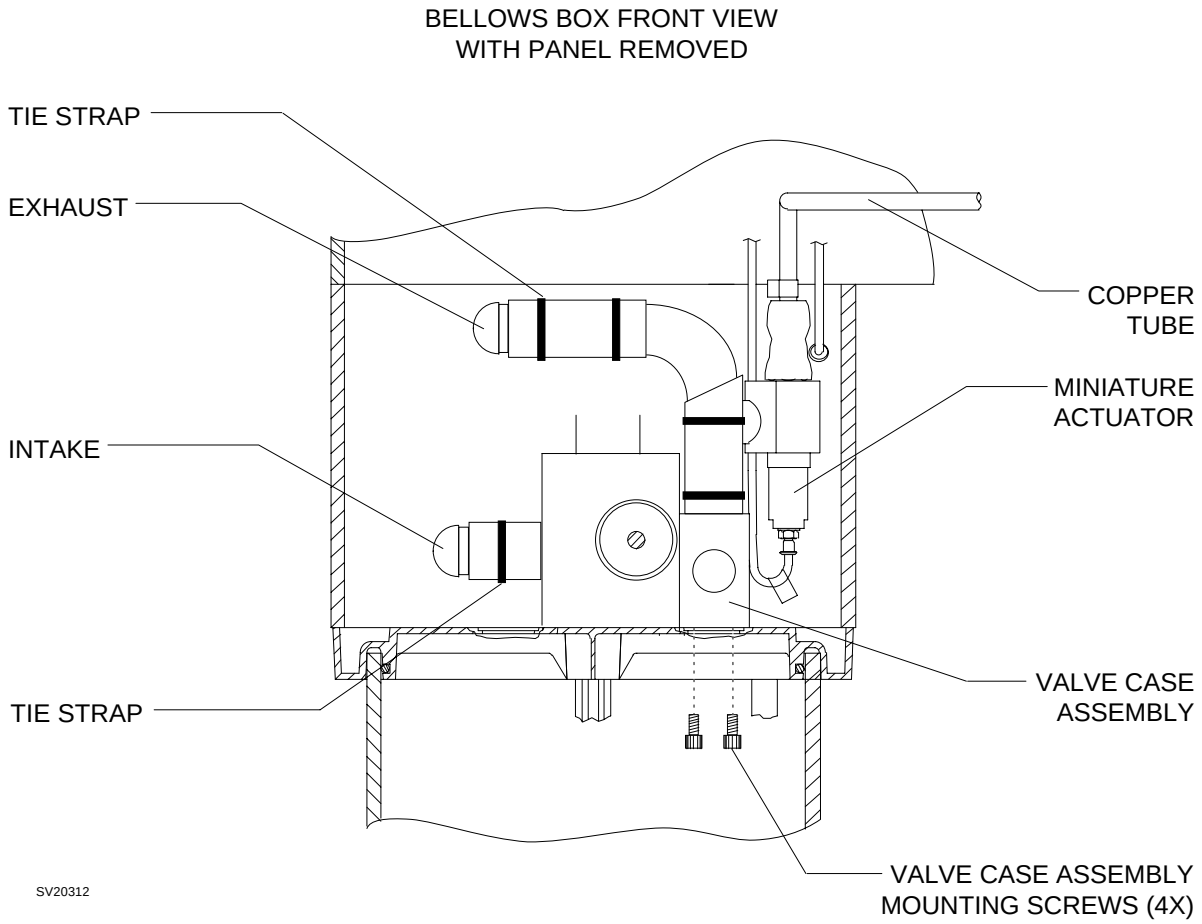


Figure 4-17: TWO-PIECE TIDAL VOLUME ADJ. & VALVE CASE ASSEMBLY (continued)

4.17.10 Carefully cut the tie strap and remove the other end of the large hose at the top of the muffler interface wall.

4.17.11 Remove the three socket head screws securing the bellows top plate to the bellows box.

4.17.12 Carefully cut the tie strap at the intake port (rear of valve) and remove the large hose.

4.17.13 Disconnect the small diameter tubing from the hose barb on the bottom of the miniature actuator.

4.17.14 Remove the screws holding the monitor box to the ventilator box.

WARNING: Two people are required to perform the remaining portion of the procedure.

4.17.15 Raise the front of the monitor box chassis approximately four inches, and prop the box open.

WARNING: Ensure that AC power is removed from the machine before raising the monitor box. Failure to observe this precaution may cause injury by electric shock.

4.17.16 Disconnect the compression fitting at the outboard end of the copper tube from the valve case assembly, and remove the valve case assembly.

4.17.17 Carefully position the replacement valve case assembly in the bellows box, with the copper tube extending up into the ventilator box, and connect the compression fitting in the ventilator box.

4.17.18 Connect the small diameter tubing to the hose barb on the bottom of the miniature actuator and secure the connection with a press-on clamp.

4.17.19 Attach the large hose to the intake port of the new valve case assembly and secure it with a new tie strap.

4.17.20 Secure the valve case assembly to the bellows top plate with the four screws that were previously removed. Be sure that the two O-rings in the bellows top plate are properly seated.

4.17.21 Secure the bellows top plate to the bellows box using the three screws that were previously removed.

4.17.22 Attach the large hose from the muffler interface wall and secure the connection with a new tie strap.

4.17.23 Attach the other large hose to the exhaust port on the valve case assembly and secure the connection with a new tie strap.

4.17.24 Remove the prop from the monitor box and carefully lower it into position. Replace the screws holding the monitor box to the ventilator box.

4.17.25 Place the bellows box front panel into position, ensure that the slot in the knob assembly is correctly aligned with the drive pin on the bellows adjustment shaft, and install the four screws holding the front panel to the machine.

4.17.26 Reattach the canister to the bellows box.

4.17.27 Reattach the bellows assembly and tighten the wingnuts holding it in place. Connect any hoses that were previously removed from the bellows assembly.

4.17.28 Reconnect the pipeline hoses and AC power cord, and reset all circuit breakers.

4.17.29 Perform the PMS Procedure given in Section 6.

Replacement Procedure 2:

4.17.30 Set the System Power switch to STANDBY, remove AC power from the machine, and disable all circuit breakers.

4.17.31 Close all cylinder valves, and disconnect the pipeline hoses from the machine.

4.17.32 Press the O_2 FLUSH button to relieve pressure from the system.

4.17.33 Adjust the TIDAL VOLUME knob to fully extend the volume indicator to its minimum setting.

4.17.34 Disconnect the bellows hose and the scavenger hose from the bellows assembly. Loosen the wingnuts and remove the bellows assembly and the canister.

4.17.35 Remove the canister from the bellows box by pulling it downward.

4.17.36 Remove the screws holding the front panel and tidal volume adjustment knob, and remove the panel. The knob assembly remains with the panel. On machines with a two-piece panel, remove the angle plate above the knob panel.

4.17.37 Remove the screws holding the monitor box to the ventilator box.

WARNING: Two people are required to perform the remaining portion of the procedure.

4.17.38 Raise the front of the monitor box chassis approximately four inches, and prop the box open.

WARNING: Ensure that AC power is removed from the machine before raising the monitor box. Failure to observe this precaution may cause injury by electric shock.

4.17.39 Remove the bellows guide by unscrewing its stem from the bellows adjustment rod.

4.17.40 Remove the volume indicator from the bellows adjustment rod by loosening its two set screws. Note the position of the indicator on the rod so that it can be reassembled in the same manner.

4.17.41 Remove the screws securing the muffler access panel at the rear of the bellows box, and remove the panel.

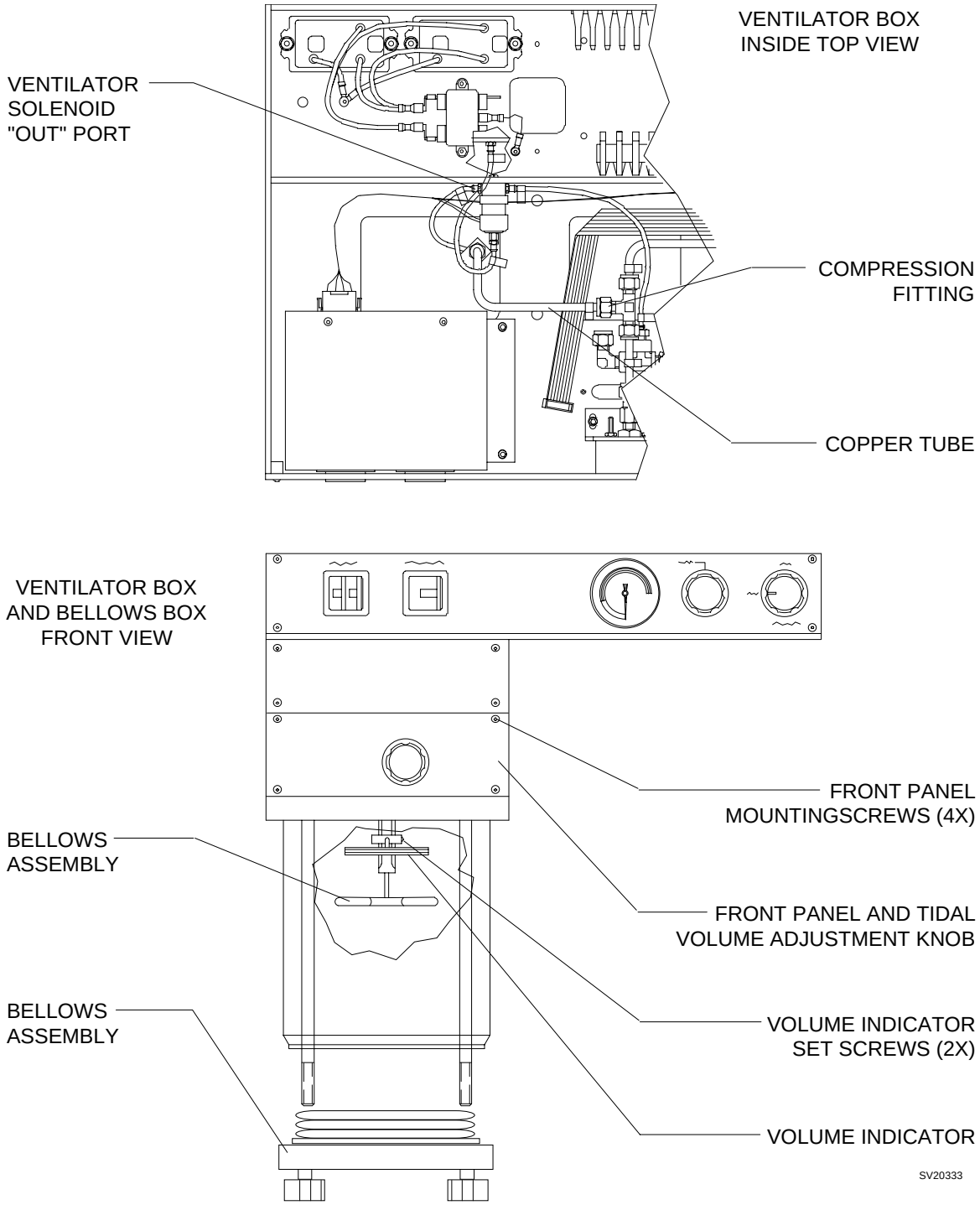


Figure 4-17A: ONE-PIECE TIDAL VOLUME ADJ. & VALVE CASE ASSEMBLY

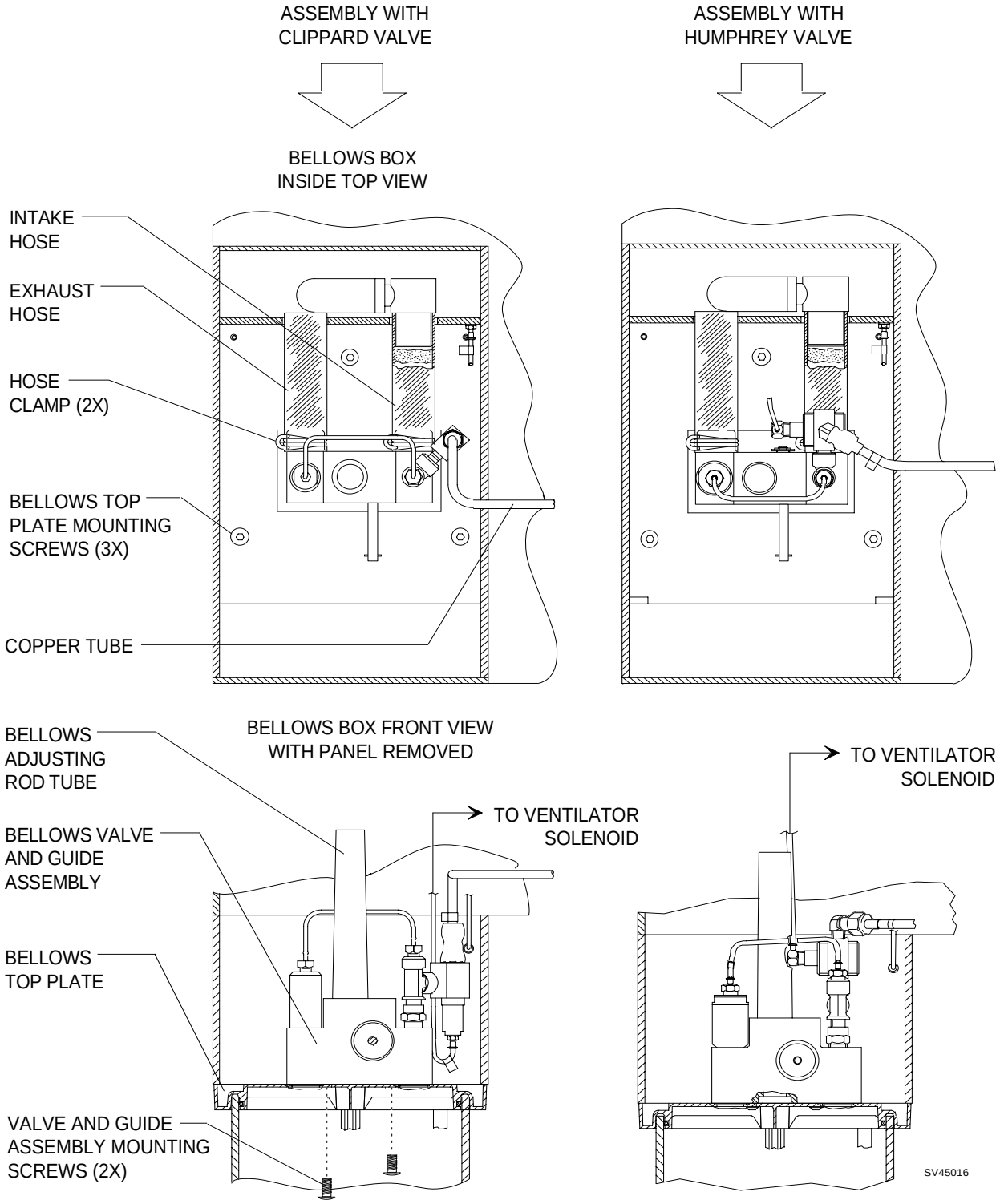


Figure 4-17A: ONE-PIECE TIDAL VOLUME ADJ. & VALVE CASE ASSEMBLY (continued)

4.17.42 Remove the muffler/silencer (white tube) from the intake flange at the interface wall by turning the muffler counter-clockwise.

4.17.43 Disconnect the press-on clamp and small diameter tubing from the left side hose barb on the ventilator solenoid valve (port labeled "out").

4.17.44 Disconnect the compression fitting at the outboard end of the copper tube from the valve case assembly.

4.17.45 Unscrew the bellows adjustment rod tube from the top of the assembly. Do not misplace the spacer ring.

4.17.46 Pull the bellows adjustment rod up.

4.17.47 Remove the two screws securing the valve case and guide assembly to the bellows top plate.

NOTE: Be careful not to misplace the two O-rings and the spacer ring under the valve case assembly.

4.17.48 Pull both large diameter tubes forward until they clear the muffler housing interface wall.

4.17.49 Rotate the valve case and guide assembly as needed in order to withdraw it from the bellows box.

CAUTION: Do not damage any of the fittings or small hose barbs on the assembly during its removal.

4.17.50 Transfer the large diameter tubing and hose clamps to the intake and exhaust ports on the replacement valve case and guide assembly.

4.17.51 Carefully position the replacement valve case and guide assembly in the bellows box, with the copper tube extending up into the ventilator box, and with the intake and exhaust hoses correctly positioned in the muffler housing interface wall.

4.17.52 Secure the valve case assembly to the bellows top plate with the two screws that were previously removed. Be sure that the spacer ring and the two O-rings in the bellows top plate are properly seated.

4.17.53 Connect the copper tube to the tee fitting in the ventilator box.

4.17.54 Install the spacer ring and bellows adjustment rod tube at the top of the valve case and guide assembly.

4.17.55 Attach the small diameter tubing from the miniature actuator to the left side hose barb on the ventilator solenoid valve (port labeled "out"), and secure the connection with a press-on clamp.

NOTE: After the connection is made, ensure that there are no kinks or sharp bends in the tubing.

4.17.56 Reattach the muffler/silencer to the intake flange at the muffler housing interface, and reattach the rear access panel using the screws that were previously removed.

4.17.57 Install the volume indicator on the bellows adjustment rod in the same position as before disassembly, and tighten its two setscrews.

4.17.58 Install the bellows guide by screwing its stem into the bellows adjustment rod. Secure it with #222 (purple) Loctite.

4.17.59 Remove the prop from the monitor box and carefully lower it into position. Replace the screws holding the monitor box to the ventilator box.

4.17.60 Place the bellows box front panel into position, ensure that the slot in the knob assembly is correctly aligned with the drive pin on the bellows adjustment shaft, and install the four screws holding the front panel to the machine.

4.17.61 Replace the bellows assembly and tighten the wingnuts holding it in place. Connect any hoses that were previously removed from the bellows assembly.

4.17.62 Reconnect the pipeline hoses and AC power cord, and reset all circuit breakers.

4.17.63 Perform the PMS Procedure given in Section 6.

4.18 Alarm Channel

Replacement of the alarm circuit board or the system power switch assembly requires that the alarm channel be removed from the machine. The top of the alarm channel is held in place by the cover plate which also retains the flowmeter shield. On later models the vapor box cover plate is extended to also cover the flowmeter shield and alarm channel. The bottom of the alarm channel is held by a screw from the back. Access to the bottom mounting screw and the alarm channel connections requires removal of the rear cover. Figure 4-18 shows a rear view of the alarm channel and the arrangement of the circuit board assembly and system power switch.

4.18.1 Disconnect the pipeline hoses and close all cylinder valves.

4.18.2 Press the O_2 Flush valve to drain oxygen pressure from the system.

4.18.3 Set the System Power switch to STANDBY and remove AC power from the machine.

4.18.4 Remove the screws holding the rear cover, and remove the cover.

4.18.5 Remove the screws holding the table top, and lift out the table top.

CAUTION: The circuit board contains static sensitive devices. Use ESD protection when handling this assembly.

4.18.6 Disconnect the cables from J1, J2, J3 and J4 on the alarm circuit board.

WARNING: Ensure that AC power is removed from the machine before disconnecting the cables. Failure to observe this precaution may cause injury by electric shock.

4.18.7 Disconnect the two compression fittings at the system power switch valve.

4.18.8A Early models: Remove the two screws (from the back) holding the angled cover plate at the top of the channel. Hold the cover plate as the screws are removed from the back.

4.18.8B Later models (without the O_2/N_2O ratio alarm lamp): Remove the six screws holding the flowmeter shield and vapor box cover, and remove the panel.

4.18.9 Feed the flowmeter lights wire harness through the hole at the top of the alarm channel.

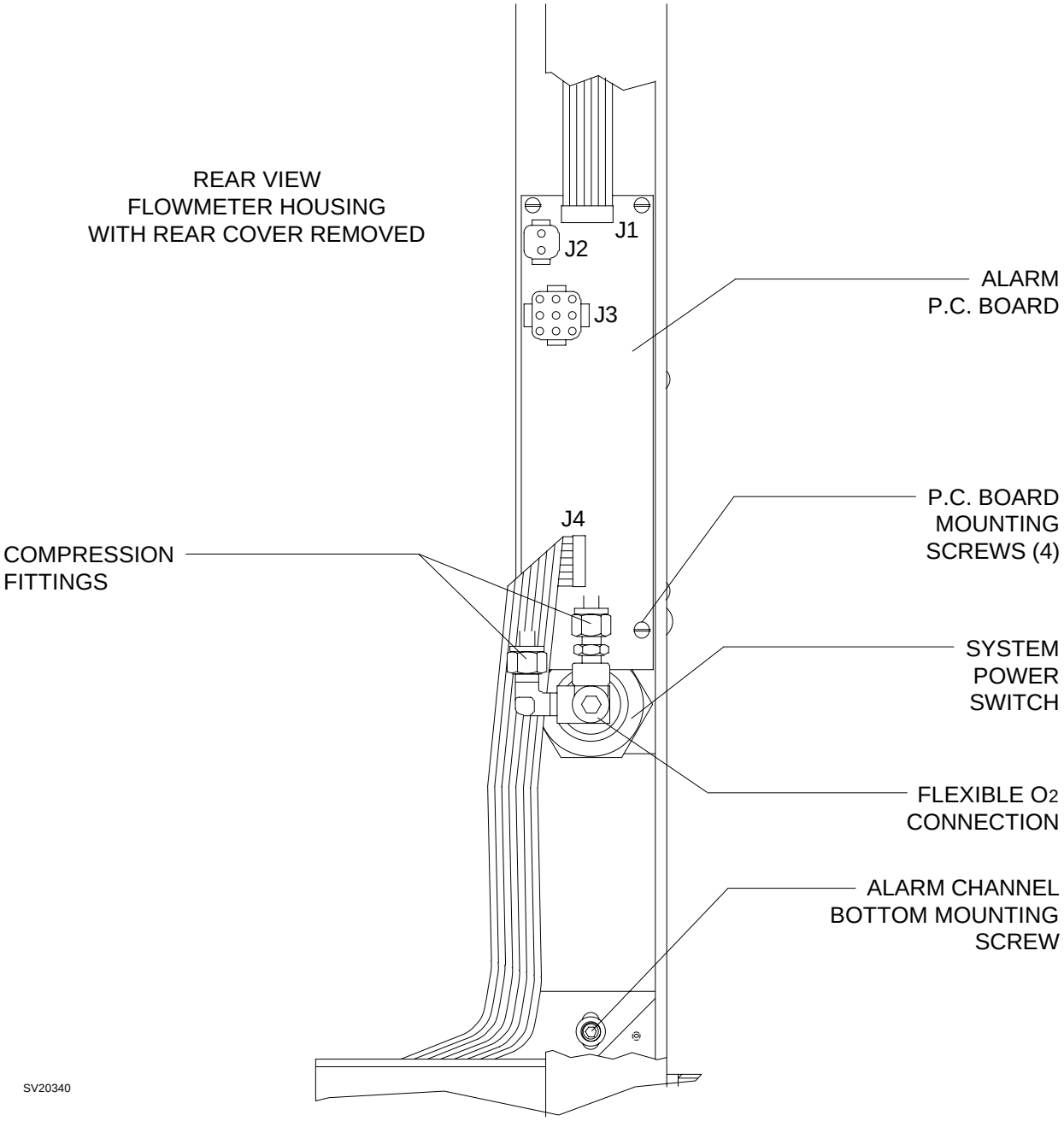


Figure 4-18: ALARM PANEL AND SYSTEM POWER SWITCH

4.18.10 Remove the bottom alarm channel mounting screw. If the machine does not have an auxiliary O_2 flow meter, proceed to Step 4.18.12.

4.18.11 If the machine is equipped with an auxiliary O_2 flow meter,pull the alarm channel forward far enough to gain access to the system power switch valve, cut the tie-wrap clamp on the flexible tube at the valve, and remove the tube from the valve.

4.18.12 Connect the flexible tube to the system power switch valve on the replacement alarm channel and install a new tie-wrap clamp.

4.18.13 Set the replacement alarm channel in position and connect the two compression fittings to the system power switch valve. Do not tighten the fittings yet.

4.18.14 Reinstall the bottom alarm channel mounting screw.

4.18.15 Feed the flowmeter lights wire harness connector through the hole at the top of the alarm channel.

4.18.16 Reinstall the cover plate at the top of the channel and secure it with the hardware that was previously removed.

4.18.17 Tighten the two compression fittings at the system power switch valve and perform the following leak test:

4.18.17.1 Open the oxygen cylinder valve and allow the pressure to stabilize.

4.18.17.2 Close the oxygen cylinder valve.

4.18.17.3 The pressure should not drop more than 50 psi in two minutes. (The cylinder pressure must be at least 1000 psi for this test.)

4.18.18 Connect the cables that were previously removed from J1, J2, J3 and J4 on the alarm circuit board.

4.18.19 Replace the rear cover and its retaining screws.

4.18.20 Replace the table top and its mounting screws.

4.18.21 Connect the pipeline hoses and restore AC power to the machine.

4.18.22 Perform the PMS Procedure given in Section 6.

4.19 Multispec Analyzer

The Multispec Analyzer comprises two assemblies: an analyzer and pump assembly located at the back of the machine, and a PCB assembly located within the monitor housing. The analyzer and pump assembly contains several field-replaceable items. These are: the fan, the scrubber bottle, the pump, and the sample cell. If the entire analyzer and pump assembly is replaced, then the PCB assembly must also be replaced as these two items are supplied as a matched set for calibration purposes. Figure 4-19 shows the Multispec Analyzer arrangement and its connections.

NOTE: For installations with a 4610 ugrade, refer to the latest version of NAD Service Procedure SP00121.

4.19.1 Set the System Power switch to STANDBY and remove AC power from the machine.

CAUTION: The circuit boards in the multispec assemblies contain static sensitive devices. Use ESD protection when handling these assemblies.

4.19.2 Analyzer and Pump Assembly:

4.19.2.1 Remove the two screws at the top of the back cover, and open the cover.

NOTE: The following procedure applies to replacement of the entire analyzer and pump assembly. Procedures for replacement of sub-assemblies begin at Paragraph 4.19.10.

4.19.2.2 Disconnect the ribbon cable from J2 on the optical head circuit board.

4.19.2.3 Disconnect the exhaust line from the lower port on the pump.

4.19.2.4 Disconnect the sample line from the solenoid valve.

4.19.2.5 Disconnect the ribbon cable from J1 on the pump controller board.

4.19.2.6 Loosen the four captive mounting screws holding the analyzer and pump assembly to the bottom of the ventilator box, and remove the assembly.

4.19.2.7 Hold the replacement assembly in place and tighten its captive mounting screws.

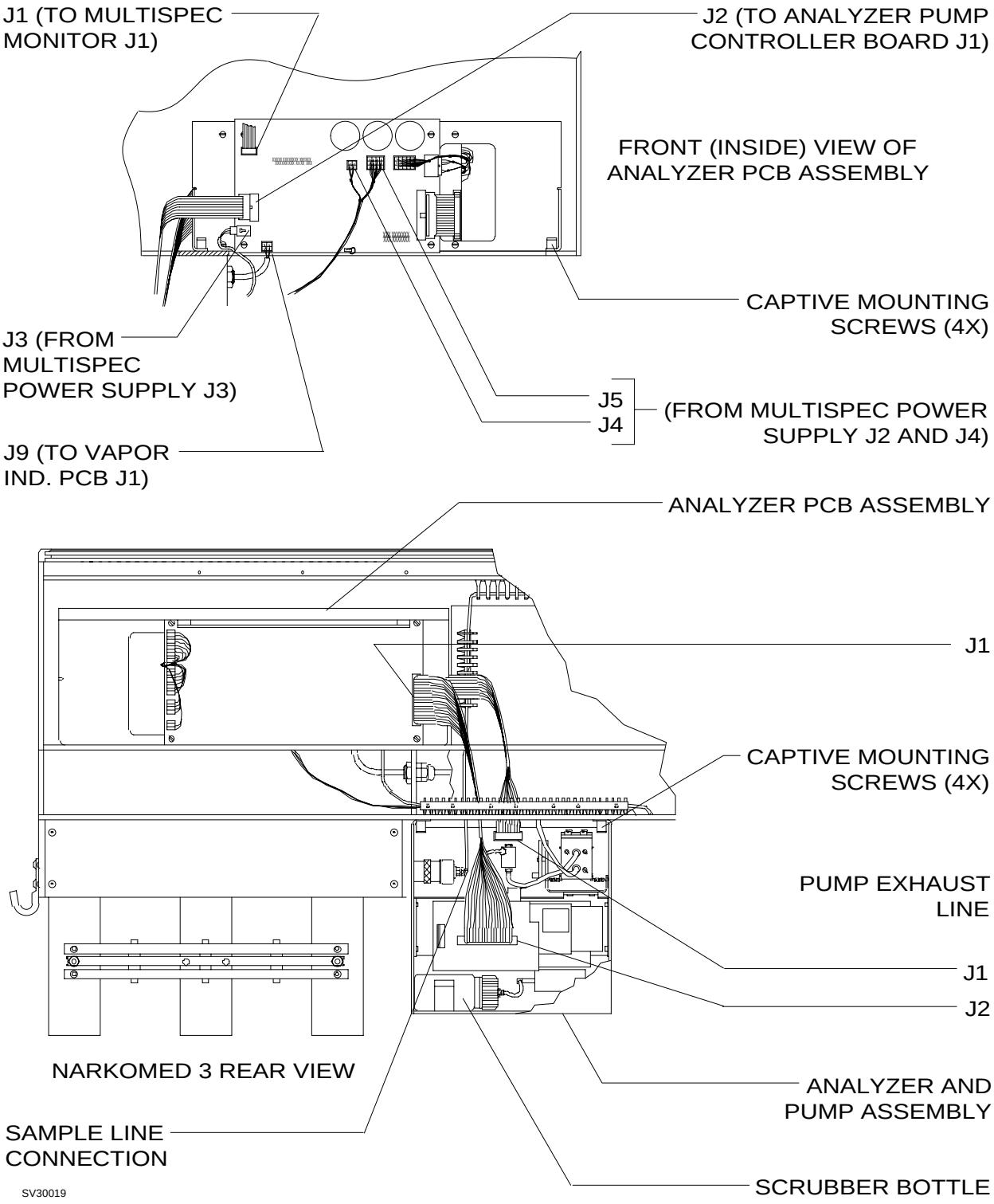


Figure 4-19: MULTISPEC ANALYZER CONNECTIONS

REAR VIEW OF ANALYZER
WITH HINGED COVER OPEN

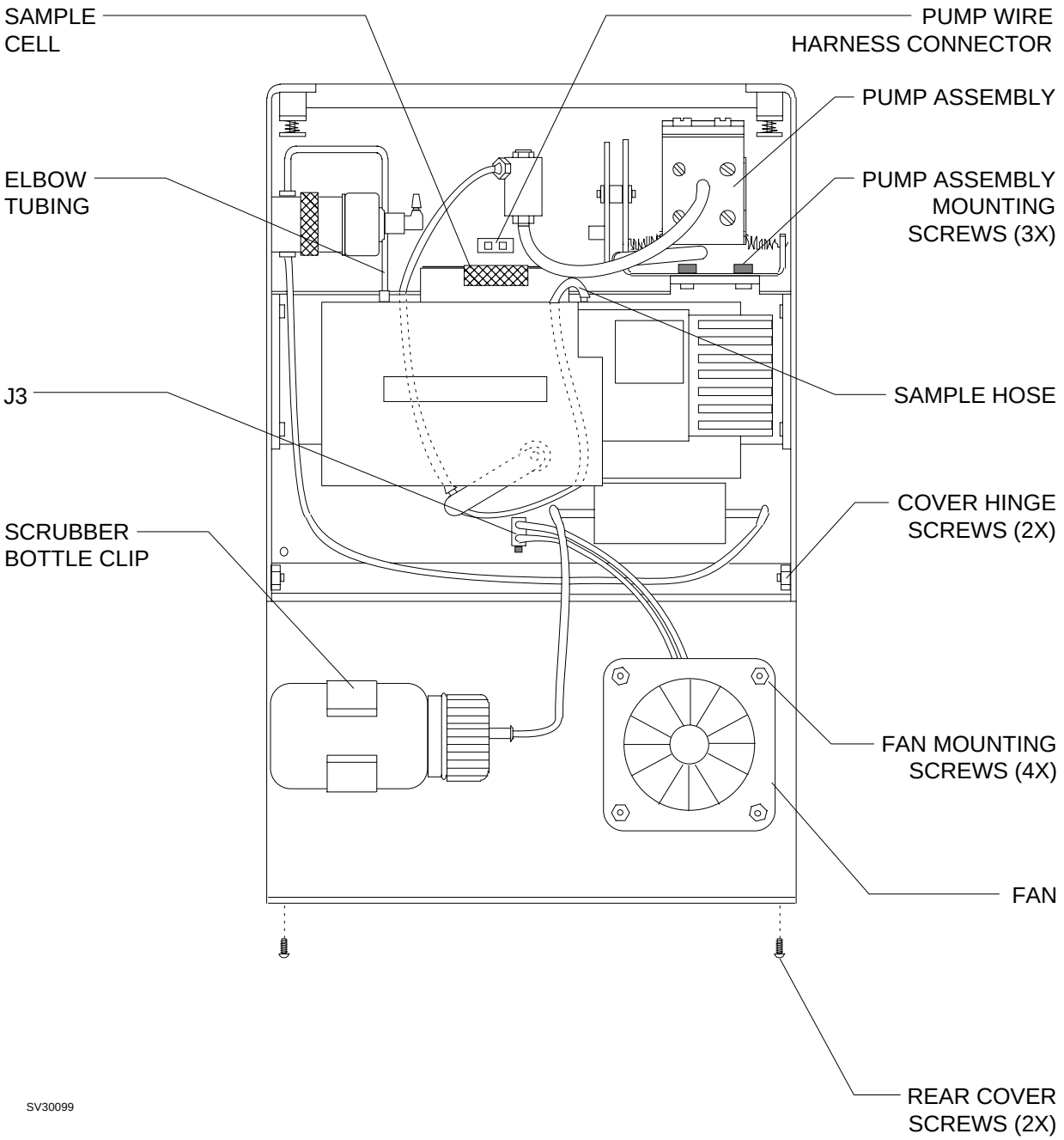


Figure 4-19 (continued): MULTISPEC ANALYZER SUBASSEMBLIES

4.19.2.8 Connect the 16-wire ribbon cable to J1 on the pump controller board.

4.19.2.9 Connect the sample line to the solenoid valve.

4.19.2.10 Connect the exhaust line to the lower port on the pump.

4.19.2.11 Connect the 40-wire ribbon cable to J2 on the optical head circuit board.

4.19.3 PCB Assembly:

4.19.3.1 Disconnect any cables from the serial interface ports at the back of the machine.

4.19.3.2 Remove the two screws holding the back panel of the monitor housing, and open the hinged back panel.

4.19.3.3 Remove the top shelf from the monitor housing and disconnect its ground wire.

4.19.3.4 Loosen the four captive mounting screws holding the PCB assembly to the floor of the monitor housing.

4.19.3.5 Disconnect the 40-wire ribbon cable from J1 on the back board of the assembly.

4.19.3.6 Disconnect the 16-wire ribbon cable from J2.

4.19.3.7 Disconnect the monitor cable from J1.

4.19.3.8 Disconnect the power supply cable from J3.

4.19.3.9 Disconnect the vapor selection indicator cable from J9.

4.19.3.10 Disconnect the power supply wiring harness cables from J4 and J5.

4.19.3.11 Remove the PCB Assembly, and position the replacement PCB Assembly in the monitor housing.

4.19.3.12 Re-connect the cables that were previously removed from J4, J5, J9, J3, J1, and J2.

4.19.3.13 Re-connect the 40-wire ribbon cable to J1 on the back board of the assembly.

4.19.3.14 Secure the PCB Assembly to the floor of the monitor housing with the four captive mounting screws.

4.19.4 Restore power to the machine and perform the multispec calibration procedures given in Section 5.

NOTE: If the entire analyzer is replaced or if the pump is replaced, the pump flow rate must be set to the correct value as described in Section 5.

4.19.5 Set the System Power switch to STANDBY and remove AC power from the machine.

4.19.6 Reinstall the top shelf of the monitor housing and re-connect its ground wire.

4.19.7 Close the back panel of the monitor housing and replace the two retaining screws. Re-connect any cables that were previously disconnected from the serial interface ports.

4.19.8 Close the cover of the analyzer and pump assembly, and replace the two retaining screws.

4.19.9 Perform the PMS Procedure given in Section 6.

4.19.10 Fan Replacement:

4.19.10.1 Remove the two screws securing the back cover of the analyzer and pump assembly, and open the hinged cover.

4.19.10.2 Disconnect the fan wire harness from J3 on the pump controller circuit board.

4.19.10.3 Remove the four fan mounting screws, and remove the fan.

4.19.10.4 Install the replacement fan. Use a small amount of loctite #222 (purple) on the mounting screw threads.

4.19.10.5 Connect the fan wire harness to J3 on the pump controller circuit board.

4.19.10.6 Proceed to Paragraph 4.19.4.

4.19.11 Scrubber Bottle Replacement:

4.19.11.1 Disconnect the inlet line at the hose barb on the bottle.

4.19.11.2 Remove the bottle from its retainer clip.

4.19.11.3 Install the replacement scrubber bottle in the retainer clip.

4.19.11.4 Connect the inlet line to the hose barb on the bottle.

4.19.11.5 Proceed to Paragraph 4.19.4.

4.19.12 Pump Replacement: (See 4.19.14 for Model 4610 pump replacement)

4.19.12.1 Remove the analyzer and pump assembly from the machine as outlined in Paragraphs 4.19.2.2 thru 4.19.2.6.

4.19.12.2 Separate the in-line pump wire harness connector.

4.19.12.3 Disconnect the tubing from the intake port on the pump.

4.19.12.4 Remove the three screws holding the pump to its mounting bracket, and remove the pump.

4.19.12.5 Secure the replacement pump to the mounting bracket with the three screws that were previously replaced.

4.19.12.6 Connect the previously removed tubing to the intake port on the replacement pump.

4.19.12.7 Join the in-line pump wire harness connector.

4.19.12.8 Reinstall the analyzer and pump assembly to the bottom of the ventilator box, and tighten the four captive mounting screws.

4.19.12.9 Connect the 16-wire ribbon cable to J1 on the pump controller board.

4.19.12.10 Connect the sample line to the solenoid valve.

4.19.12.11 Connect the exhaust line to the lower port on the pump.

4.19.12.12 Connect the 40-wire ribbon cable to J2 on the optical head circuit board.

4.19.12.13 Proceed to Paragraph 4.19.4.

4.19.13 Sample Cell Replacement:

4.19.13.1 Remove the analyzer and pump assembly from the machine as outlined in Paragraphs 4.19.2.2 thru 4.19.2.6.

4.19.13.2 Disconnect the fan wire harness from J3 on the pump controller circuit board.

4.19.13.3 Disconnect the hose from the scrubber bottle and remove the scrubber bottle.

4.19.13.4 Remove the two hinge screws and nuts holding the analyzer and pump assembly cover, and remove the cover.

4.19.13.5 Disconnect the elbow tubing from the left side hose barb of the sample cell.

4.19.13.6 Disconnect the sample hose from the right side hose barb of the sample cell.

4.19.13.7 Turn the thumbscrew of the sample cell counter-clockwise until its locking tab releases.

4.19.13.8 Carefully lift the sample cell from its chamber.

4.19.13.9 Install the replacement sample cell in the chamber, with the locking tab on the thumbscrew pointing to the left. Lock the cell in place by applying a slight downward pressure to the top of the cell while turning the thumbscrew clockwise.

4.19.13.10 Connect the sample hose to the right side hose barb of the sample cell.

4.19.13.11 Connect the elbow tubing to the left side hose barb of the sample cell.

4.19.13.12 Reinstall the cover with the two hinge screws and nuts.

4.19.13.13 Reinstall the scrubber bottle and connect the hose that was previously removed from the scrubber bottle.

4.19.13.14 Connect the fan wire harness to J3 on the pump controller board.

4.19.13.15 Reinstall the analyzer and pump assembly to the bottom of the ventilator box, and tighten the four captive mounting screws.

4.19.13.16 Connect the 16-wire ribbon cable to J1 on the pump controller board.

4.19.13.17 Connect the sample line to the solenoid valve.

4.19.13.18 Connect the exhaust line to the lower port on the pump.

4.19.13.19 Connect the 40-wire ribbon cable to J2 on the optical head circuit board.

4.19.13.20 Proceed to Paragraph 4.19.4.

4.19.14 Pump Replacement: Model 4610

4.19.14.1 Disconnect the Andros 34-conductor ribbon cable at P1 in the monitor housing.

4.19.14.2 Disconnect the exhaust line from the hose barb on the variable restrictor. See Figure 2.

4.19.14.3 Disconnect the sample line from the T-fitting hose barb as shown in the illustration.

CAUTION: Refer to TSB #114 for the next step.

4.19.14.4 Locate the elbow on the end of the tubing that comes from the tee fitting in the pump intake line. Disconnect this elbow at the one inch piece of tubing attached to the Andros board on the front of the PCB assembly. See Figure 3.

4.19.14.5 Disconnect the pump cable from J1 on the GAI board.

4.19.14.6 Disconnect the solenoid cable from J14 on the GAI board.

4.19.14.7 Disconnect the fan cable from J8 on the GAI board.

4.19.14.8 Feed the solenoid, pump and fan cables down into the analyzer and pump assembly housing.

4.19.14.9 Loosen the four captive mounting screws (ref. Figure 2) and separate the analyzer & pump assembly from the machine.

4.19.14.10 Place the analyzer & pump assembly on an ESD-safe surface.

4.19.14.11 Disconnect the intake and exhaust hoses at the pump.

4.19.14.12 Loosen the three pump bracket mounting screws; remove the pump and bracket from the analyzer housing.

4.19.14.13 Remove the pump from the mounting bracket by disconnecting the four springs.

4.19.14.14 Attach the replacement pump (P/N 4112578-001) to the mounting bracket by attaching the four springs.

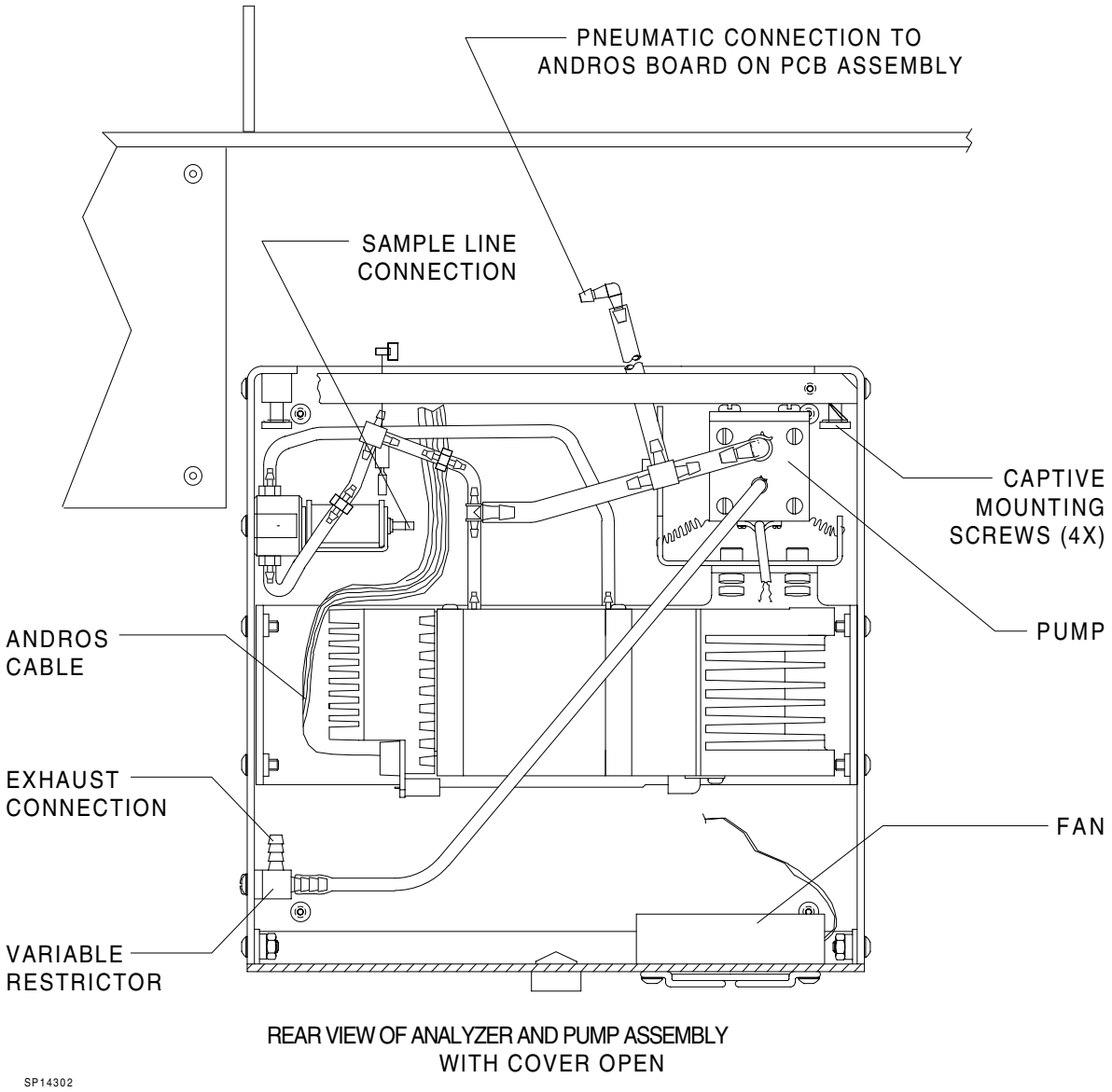


Figure 19A: ANALYZER AND PUMP ASSEMBLY

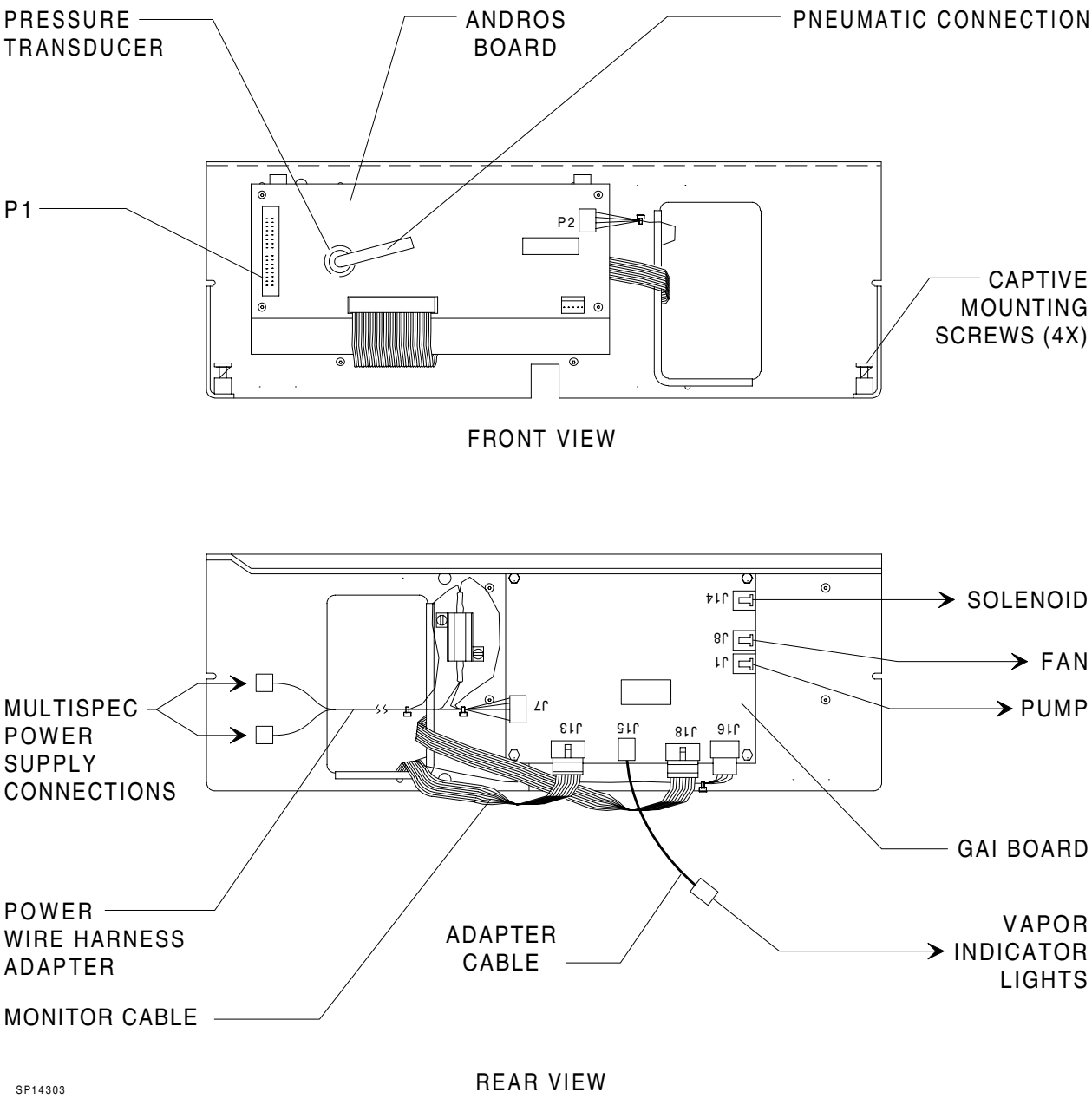


Figure 19B: ANALYZER PCB ASSEMBLY

4.19.14.15 Position the pump and bracket inside the analyzer housing, and reinstall the bracket with the three screws that were previously removed.

4.19.14.16 Connect the tube from the T-fitting to the inlet side of the pump, and secure the connection with the hose clamp.

4.19.14.17 Connect the tube from the flow restrictor to the exhaust side of the pump, and secure the connection with the hose clamp.

4.19.14.18 Position the analyzer & pump assembly at the back of the machine, and tighten the four captive mounting screws to secure the assembly to the machine. Ref. Figure 2.

4.19.14.19 Feed the solenoid, pump and fan cables from the analyzer & pump assembly up into the monitor housing.

4.19.14.20 Connect the fan cable to J8 on the GAI board.

4.19.14.21 Connect the solenoid cable to J14 on the GAI board.

4.19.14.22 Connect the pump cable to J1 on the GAI board.

4.19.14.23 Locate the elbow on the end of the tubing that comes from the tee fitting in the pump intake line. Connect this elbow to the one inch piece of tubing attached to the Andros board on the front of the PCB assembly.

4.19.14.24 Connect the sample line to the T-fitting hose barb as shown in Figure 2.

4.19.14.25 Connect the exhaust line to the hose barb on the variable restrictor.

4.19.14.26 Feed the Andros 34-conductor ribbon cable up into the monitor housing and connect it to the Andros board on the PCB assembly.

4.19.14.27 Close the analyzer & pump assembly cover and the NM3 covers, and reinstall all retaining screws.

4.19.14.28 Proceed to Step 4.19.4.

4.20 ECC (Serial Interface) Module

The ECC Module is mounted on the inside back cover of the monitor housing, with its five serial port connectors accessible from the underside of the back cover. Figure 4-20 shows the mounting arrangement and location of the data and power cable connections to the module.

4.20.1 Set the System Power switch to STANDBY and remove AC power from the machine.

4.20.2 Disconnect any cables connected to the serial interface ports.

4.20.3 Remove the two monitor housing back cover retainer screws, and swing open the back cover.

CAUTION: The circuit boards in the ECC module contain static sensitive devices. Use ESD protection when handling this module.

4.20.4 Disconnect the ribbon cable from J4 on the ECC module.

4.20.5 Disconnect the wiring harness from J3 on the ECC module.

4.20.6 Remove the ground wire connection from the back cover.

4.20.7 Close the monitor housing back cover and remove the four screws holding the ECC module to the cover.

4.20.8 Open the back cover and remove the module.

4.20.9 Position the replacement module inside the back cover, and raise the cover far enough to allow threading the mounting screws into the module. Close the back cover and tighten the mounting screws.

4.20.10 Open the back cover and connect the data and power cables to J4 and J3 on the ECC module.

4.20.11 Connect the ground wire to the back cover.

4.20.12 Close the monitor housing back cover and replace the retaining screws. Re-connect any external cables that were previously removed from the serial ports.

4.20.13 Perform the PMS Procedure given in Section 6.

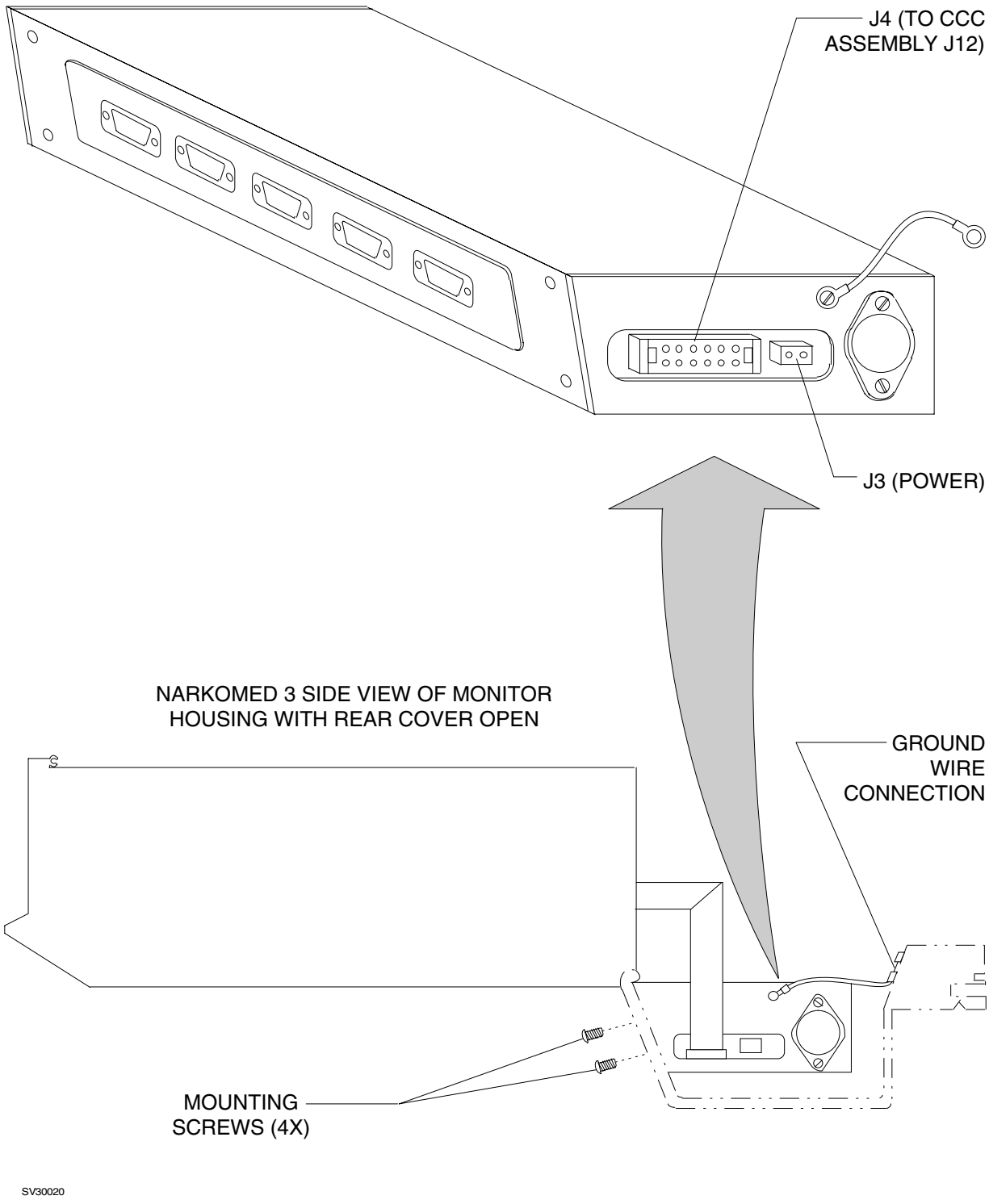

J4 (TO CCC ASSEMBLY J12)
J3 (POWER)
NARKOMED 3 SIDE VIEW OF MONITOR HOUSING WITH REAR COVER OPEN
GROUND WIRE CONNECTION
MOUNTING SCREWS (4X)
SV30020

Figure 4-20: ECC (SERIAL INTERFACE) MODULE

4.21 Sphygmomed Module

The Sphygmomed Module is located inside the ventilator box as shown in Figure 4-21. Access to the module requires disconnecting cables from the Multispec PCB assembly in the monitor housing, and raising the monitor housing to provide clearance for removing the module.

4.21.1 Set the System Power switch to STANDBY and remove AC power from the machine.

4.21.2 Disconnect any external serial interface cables from the back of the monitor housing.

4.21.3 Remove the two monitor housing back cover retainer screws, and swing open the back cover.

4.21.4 Remove the top shelf from the monitor housing and disconnect its ground wire.

CAUTION: The circuit boards in the sphygmomed module and the multispec PCB assembly contain static sensitive devices. Use ESD protection when handling these assemblies.

4.21.5 Loosen the captive mounting screws on the multispec PCB assembly, disconnect all of the cables attached to the assembly, and remove the PCB assembly from the monitor housing. (Ref.: 4.19, Multispec Analyzer)

4.21.6 Remove the screws holding the monitor housing to the ventilator box.

4.21.7 Raise the back of the monitor housing and prop it open far enough to gain access to the sphygmomed module.

4.21.8 Disconnect the monitor cable from J3 on the sphygmomed module, and disconnect the power supply cable from J1.

4.21.9 Remove the ground wire connection from the floor of the ventilator box.

4.21.10 Disconnect the cuff tubing at the in-line hose connector.

4.21.11 Remove the two screws holding the sphygmomed module. These screws are accessible from the bottom of the ventilator box. Lift the module from the ventilator box.

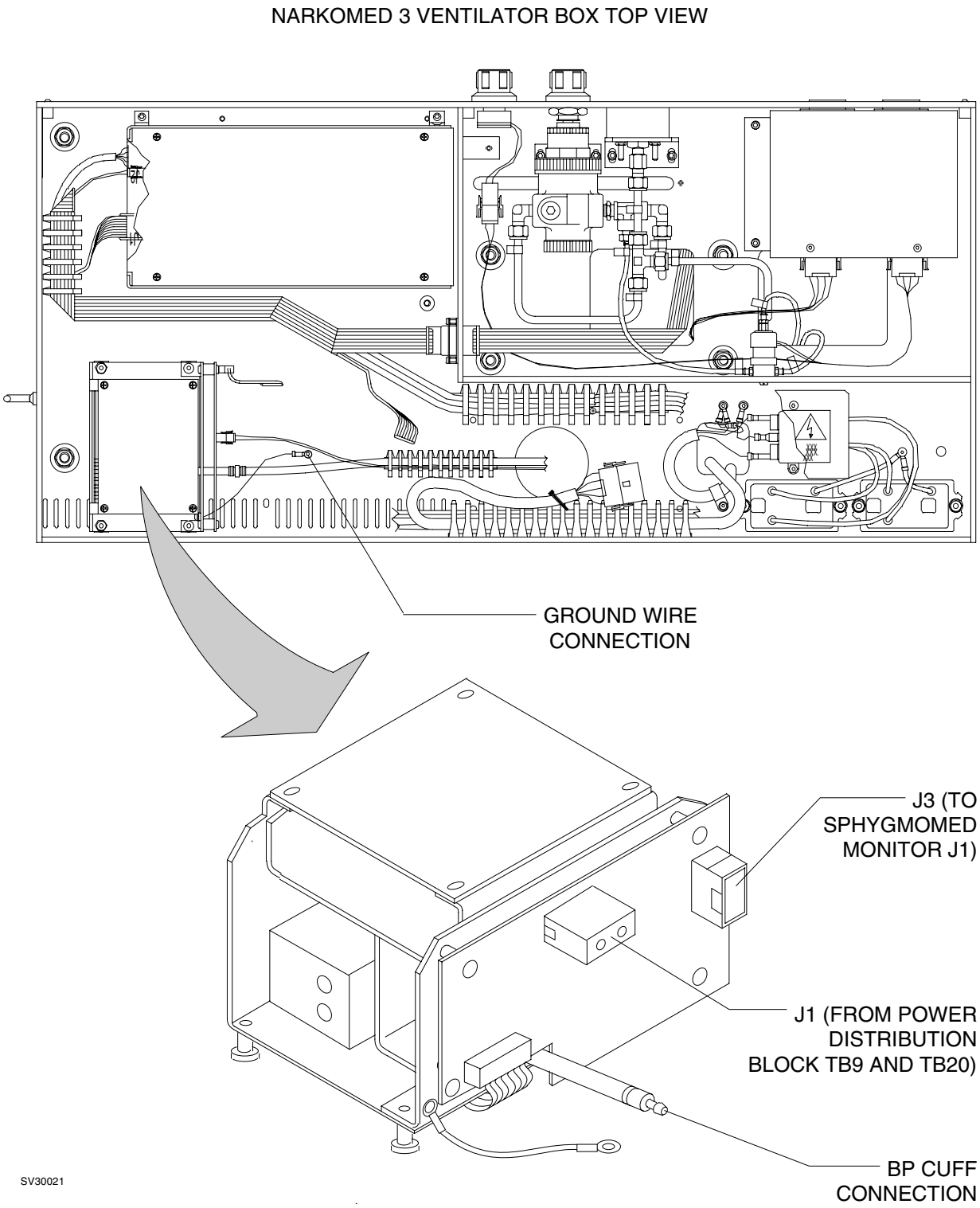

NARKOMED 3 VENTILATOR BOX TOP VIEW
GROUND WIRE CONNECTION
J3 (TO SPHYGMOMED MONITOR J1)
J1 (FROM POWER DISTRIBUTION BLOCK TB9 AND TB20)
BP CUFF CONNECTION
SV30021

Figure 4-21: SPHYGMOMED MODULE

4.21.12 Position the replacement sphygmomed module in the ventilator box and secure it with the two mounting screws that were previously removed.

4.21.13 Connect the cuff tubing at the in-line hose connector.

4.21.14 Connect the ground wire to the floor of the ventilator box.

4.21.15 Connect the power and monitor cables to J1 and J3 on the replacement module.

4.21.16 Carefully remove the prop and lower the monitor housing into place. Reinstall the screws holding the monitor housing to the ventilator box.

4.21.17 Reinstall the multispec PCB assembly by connecting the cables that were previously removed and securing it to the monitor housing.

4.21.18 Reinstall the top shelf on the monitor housing and re-connect its ground wire.

4.21.19 Close the monitor housing back cover and replace the retaining screws. Re-connect any external cables that were previously removed from the serial ports.

4.21.20 Perform the PMS Procedure given in Section 6.

4.22 Monitors (Typical)

The six separate monitors have a similar backplane mounting and electrical connection arrangement. The Baromed monitor also has a pneumatic sensor connection which is detailed in Figure 4-22. Access to the top two monitors (O_2Med and Baromed) requires removal of the monitor housing top shelf. Access to the other monitors requires removal of the Multispec PCB assembly from the monitor housing.

4.22.1 Set the System Power switch to STANDBY and remove AC power from the machine.

4.22.2 Disconnect any external serial interface cables from the back of the monitor housing.

4.22.3 Remove the two monitor housing back cover retainer screws, and swing open the back cover.

4.22.4 Remove the top shelf from the monitor housing and disconnect its ground wire.

CAUTION: The circuit boards in the monitors contain static sensitive devices. Use ESD protection when handling these assemblies.

NOTE: For the Baromed monitor and the O_2Med monitor, proceed to Paragraph 4.22.7.

4.22.5 Loosen the captive mounting screws on the multispec PCB assembly, disconnect all of the cables attached to the assembly, and remove the PCB assembly from the monitor housing. (Ref.: 4.19, Multispec Analyzer)

4.22.6 Disconnect the ribbon cable that crosses over the top of the monitors from J1 on the trend/CRT controller PCB, to J3 on the CCC/main PCB.

4.22.7 Disconnect the input cable from J1 on the back of the monitor being removed.

For the Baromed monitor, disconnect the pneumatic sensor line at the 90° fitting as shown in the illustration. Be careful not to damage the hose barb on the monitor.

4.22.8 At the front panel, remove the left or right monitor bezel by carefully prying its top tab outward, and lifting the bezel out of the panel.

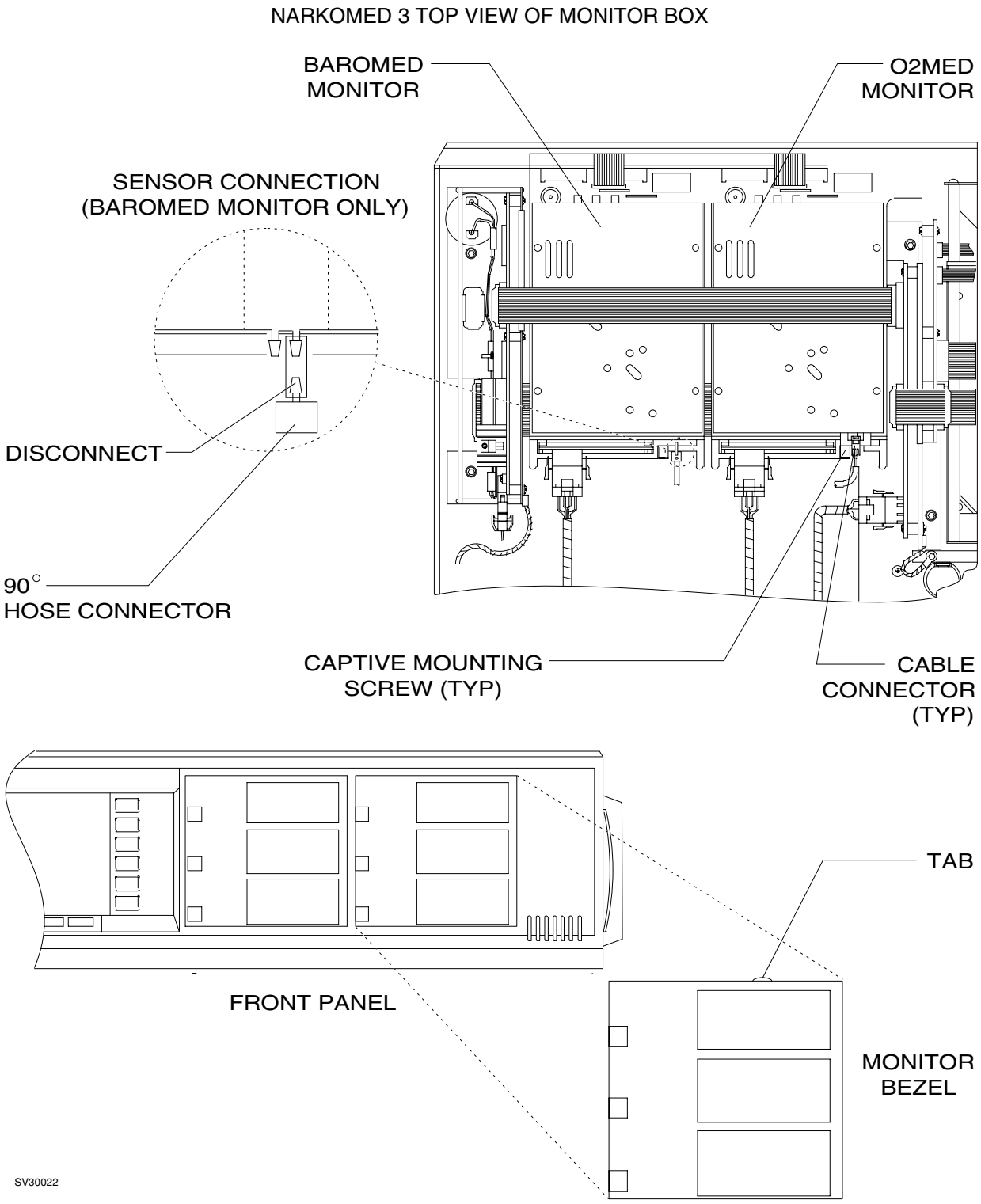


Figure 4-22: MONITOR REPLACEMENT (TYPICAL)

4.22.9 Loosen the captive mounting screw holding the monitor to the backplane. Carefully press on the back edge of the monitor chassis with a screwdriver to un-plug the monitor from the backplane, and withdraw the monitor from the front panel.

4.22.10 Slide the replacement monitor through the front panel and press it firmly into its backplane connector.

4.22.11 Tighten the captive mounting screw on the backplane.

4.22.12 Reinstall the monitor bezel in the front panel, making sure that its index tab is properly seated in the panel.

4.22.13 Connect the input cable to J1 on the monitor.

For the Baromed monitor, connect the pneumatic sensor line.

4.22.14 If applicable, reinstall the ribbon cable from J3 on the CCC/main PCB to J1 on the trend/CRT controller PCB.

4.22.15 If applicable, reinstall the multispec PCB assembly by connecting the cables that were previously removed and securing it to the monitor housing.

4.22.16 Reinstall the top shelf on the monitor housing and re-connect its ground wire.

4.22.17 Close the monitor housing back cover and replace the retaining screws. Re-connect any external cables that were previously removed from the serial ports.

4.22.18 Perform the PMS Procedure given in Section 6.

4.23 Trend Assembly

The Trend assembly is located near the center of the monitor housing and comprises two circuit boards: the CRT controller PCB and the MUX junction PCB. Figure 4-23 shows the external connections to each circuit board and the mounting arrangement of the assembly.

4.23.1 Set the System Power switch to STANDBY and remove AC power from the machine.

4.23.2 Disconnect any external serial interface cables from the back of the monitor housing.

4.23.3 Remove the two monitor housing back cover retainer screws, and swing open the back cover.

4.23.4 Remove the top shelf from the monitor housing and disconnect its ground wire.

CAUTION: The circuit boards in the trend assembly contain static sensitive devices. Use ESD protection when handling this assembly.

4.23.5 Disconnect the power cable from J5 on the CRT controller PCB.

4.23.6 Disconnect the ground wire from the monitor housing chassis.

4.23.7 Disconnect the ribbon cable from J1 on the CRT controller PCB.

4.23.8 Disconnect the following cables from the MUX junction PCB: J1, J3, J5, J7 and J8.

4.23.9 Loosen the captive mounting screws holding the assembly to the floor of the monitor housing.

4.23.10 Carefully lift the assembly far enough to gain access to the data CRT keypad cable connected to J2 on the MUX junction PCB. Disconnect the cable and remove the trend assembly.

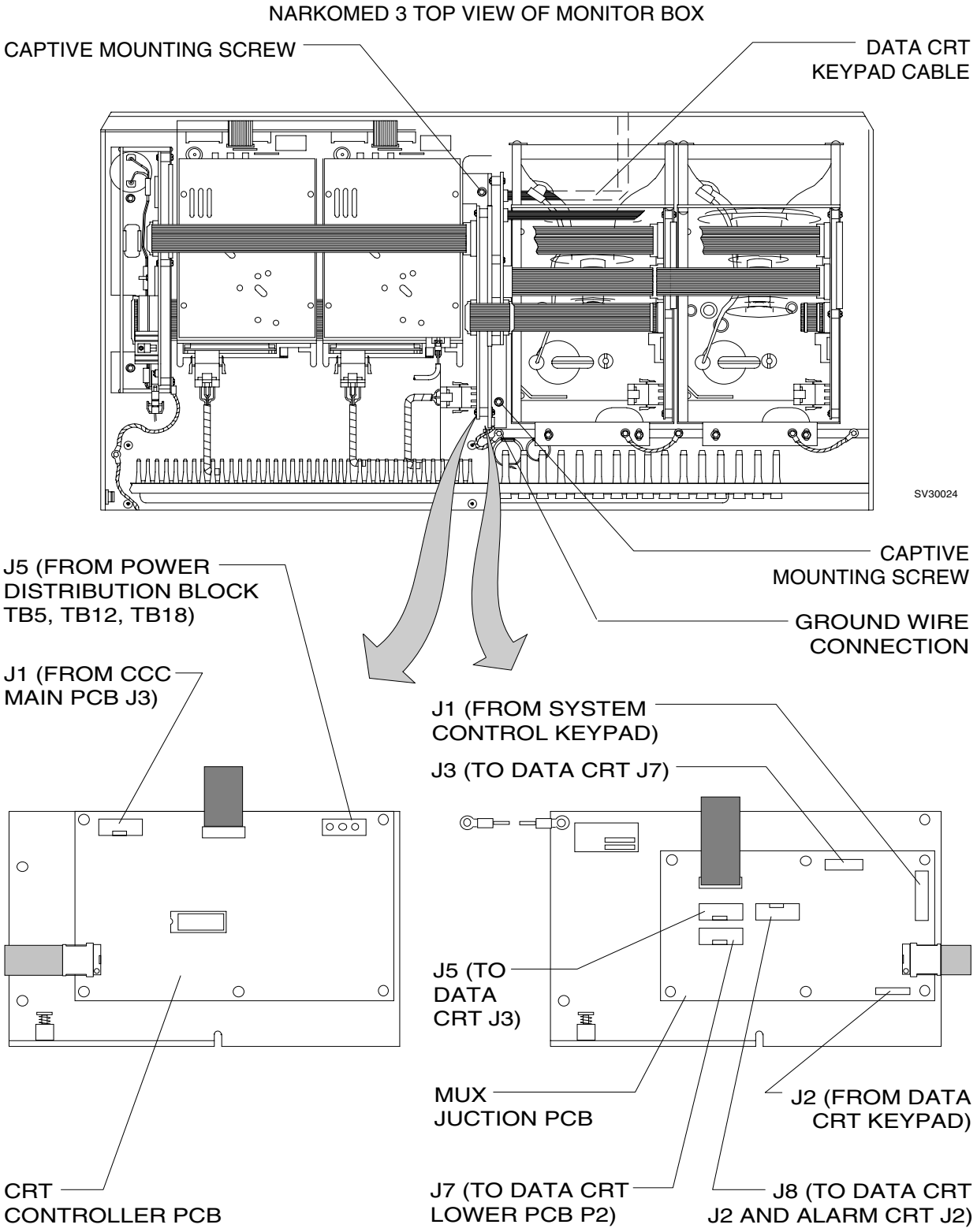

NARKOMED 3 TOP VIEW OF MONITOR BOX
CAPTIVE MOUNTING SCREW
DATA CRT KEYPAD CABLE
SV30024
CAPTIVE MOUNTING SCREW
GROUND WIRE CONNECTION
J5 (FROM POWER DISTRIBUTION BLOCK TB5, TB12, TB18)
J1 (FROM CCC MAIN PCB J3)
J1 (FROM SYSTEM CONTROL KEYPAD)
J3 (TO DATA CRT J7)
J5 (TO DATA CRT J3)
MUX JUCTION PCB
J2 (FROM DATA CRT KEYPAD)
CRT CONTROLLER PCB
J7 (TO DATA CRT LOWER PCB P2)
J8 (TO DATA CRT J2 AND ALARM CRT J2)

Figure 4-23: TREND ASSEMBLY

4.23.11 Connect the data CRT keypad cable to J2 on the MUX junction PCB of the replacement trend assembly, and secure the assembly to the floor of the monitor housing with the two captive mounting screws.

4.23.12 Connect the previously removed cables to the following points on the MUX junction PCB:

J1 (from system control keypad)
J3 (to data CRT J7)
J5 (to data CRT J3)
J7 (to data CRT P2)
J8 (to data CRT J2 and alarm CRT J2)

4.23.13 Connect the ground wire to the monitor housing chassis.

4.23.14 Connect the previously removed cables to the following points on the CRT controller PCB:

J1 (from CCC main PCB J3)
J5 (power)

4.23.15 Reinstall the top shelf on the monitor housing and re-connect its ground wire.

4.23.16 Close the monitor housing back cover and replace the retaining screws. Re-connect any external cables that were previously removed from the serial ports.

4.23.17 Perform the PMS Procedure given in Section 6.

4.24 CCC (Central Communication Controller) Assembly

The CCC assembly is located in the monitor housing between the monitors and the outside wall of the housing. The assembly comprises two circuit boards: the main PCB and the interface PCB. Figure 4-24 shows the external connections to each circuit board and the mounting arrangement of the assembly.

4.24.1 Set the System Power switch to STANDBY and remove AC power from the machine.

4.24.2 Disconnect any external serial interface cables from the back of the monitor housing.

4.24.3 Remove the two monitor housing back cover retainer screws, and swing open the back cover.

4.24.4 Remove the top shelf from the monitor housing and disconnect its ground wire.

CAUTION: The circuit boards in the CCC assembly contain static sensitive devices. Use ESD protection when handling this assembly.

4.24.5 Disconnect the power cable from J10 on the main PCB.

4.24.6 Disconnect the ribbon cable from J12 on the main PCB.

4.24.7 Disconnect the ground wire from the monitor housing.

4.24.8 Loosen the captive mounting screws holding the assembly to the floor of the monitor housing.

4.24.9 Carefully lift the assembly and disconnect the ribbon cables from J3, J4, J5, and J7 on the main PCB.

4.24.10 Disconnect the backplane cables from J2 and J3 on the interface PCB, and remove the assembly.

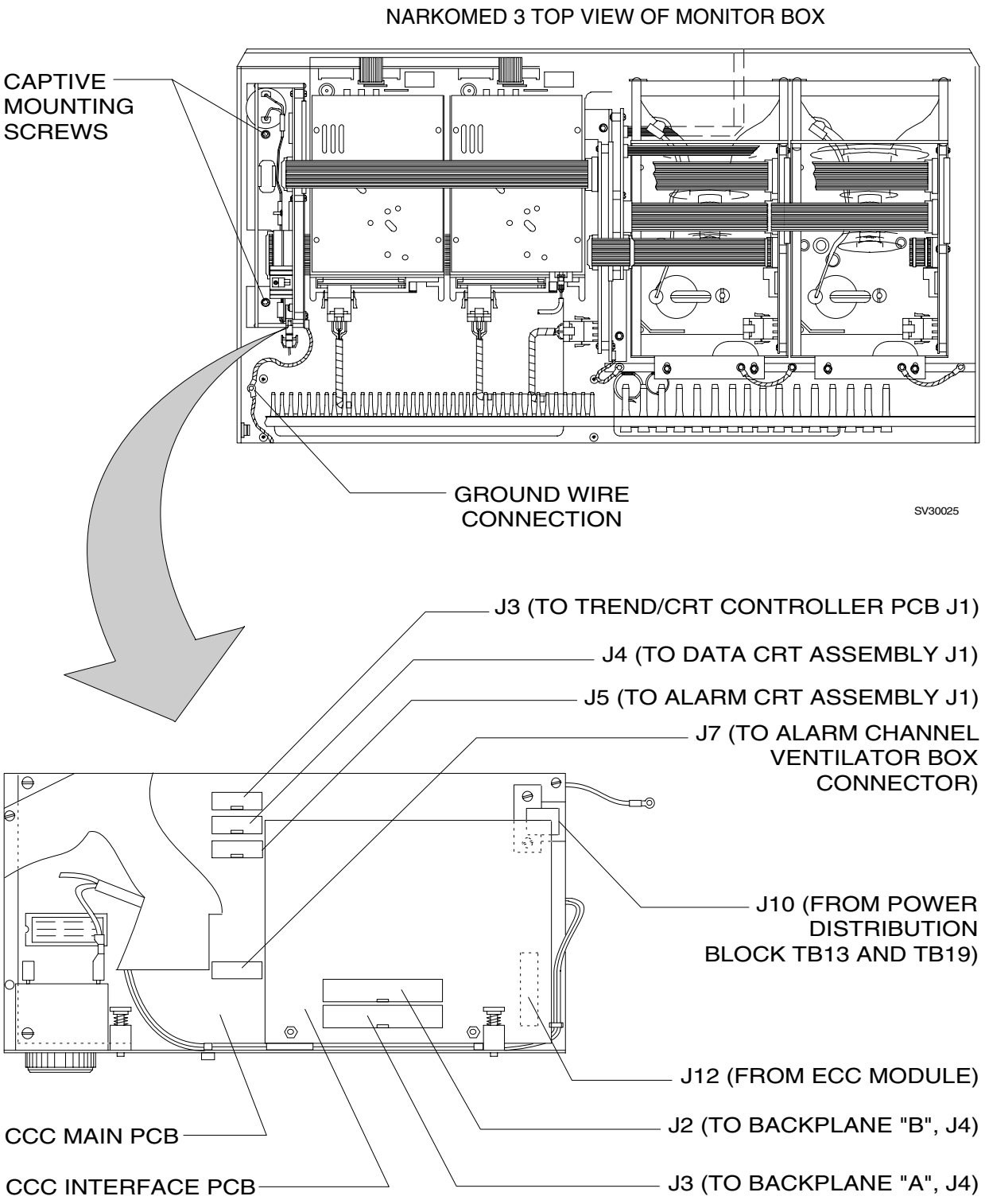

NARKOMED 3 TOP VIEW OF MONITOR BOX
CAPTIVE MOUNTING SCREWS
GROUND WIRE CONNECTION
SV30025
J3 (TO TREND/CRT CONTROLLER PCB J1)
J4 (TO DATA CRT ASSEMBLY J1)
J5 (TO ALARM CRT ASSEMBLY J1)
J7 (TO ALARM CHANNEL VENTILATOR BOX CONNECTOR)
J10 (FROM POWER DISTRIBUTION BLOCK TB13 AND TB19)
J12 (FROM ECC MODULE)
J2 (TO BACKPLANE "B", J4)
J3 (TO BACKPLANE "A", J4)
CCC MAIN PCB
CCC INTERFACE PCB

Figure 4-24: CCC ASSEMBLY

4.24.11 Connect the backplane cables to the replacement CCC assembly interface PCB as follows:

J2 (to backplane "B" J4)
J3 (to backplane "A" J4)

4.24.12 Connect the previously removed cables to the following points on the main PCB:

J7 (alarm channel cable to ventilator box connector)
J3 (to trend/CRT controller PCB J1)
J4 (to data CRT assembly J1)
J5 (to alarm CRT assembly J1)

4.24.13 Secure the assembly to the floor of the monitor housing with the two captive mounting screws.

4.24.14 Connect the ribbon cable from the ECC module to J12 on the main PCB.

4.24.15 Connect the ground wire to the monitor housing chassis.

4.24.16 Connect the power cable to J10 on the main PCB.

4.24.17 Reinstall the top shelf on the monitor housing and re-connect its ground wire.

4.24.18 Close the monitor housing back cover and replace the retaining screws. Re-connect any external cables that were previously removed from the serial ports.

4.24.19 Perform the PMS Procedure given in Section 6.

4.25 CRT Assemblies

The location and mounting arrangement for the data CRT and the alarm CRT is shown Figure 4-25, along with the electrical connections for each CRT assembly.

4.25.1 Set the System Power switch to STANDBY and remove AC power from the machine.

4.25.2 Disconnect any external serial interface cables from the back of the monitor housing.

4.25.3 Remove the two monitor housing back cover retainer screws, and swing open the back cover.

4.25.4 Remove the top shelf from the monitor housing and disconnect its ground wire.

CAUTION: The circuit boards in the CRT assemblies contain static sensitive devices. Use ESD protection when handling these assemblies.

4.25.5 Disconnect the power cable from J5.

4.25.6 Disconnect the ground wire.

4.25.7 Disconnect the ribbon cables from J1 and J2 on both CRT assemblies.

4.25.8 Disconnect the ribbon cable from J3 (data CRT only).

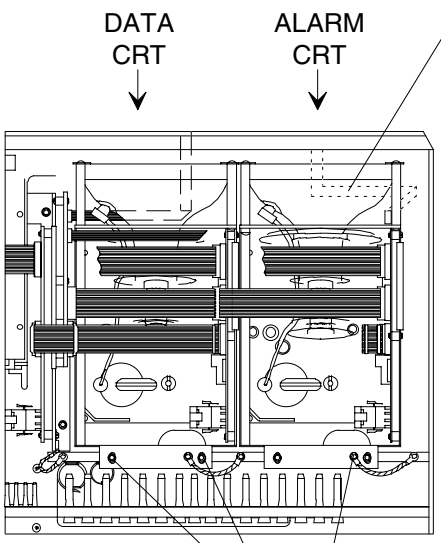
4.25.9 Disconnect the ribbon cable from P2 on the lower CRT circuit board (data CRT only).

4.25.10 Disconnect the cable from J7.

NOTE: On the alarm CRT, this cable is part of the alarm CRT keypad. Mark the cable connector and note the routing of this cable so that it can be connected to the replacement CRT assembly in the same manner.

4.25.11 Remove the two mounting screws and washers at the back of the CRT assembly. Slide the assembly back and carefully lift it from the monitor housing.

NARKOMED 3 TOP VIEW OF MONITOR BOX



DATA CRT EXTERNAL CABLE DESTINATIONS

J1	J2	J3	P2	J5	J7
CCC/ MAIN J4	TREND/ MUX J8	TREND/ MUX J5	TREND/ MUX J7	TB7 TB15 TB22	TREND/ MUX J3

ALARM CRT EXTERNAL CABLE DESTINATIONS

J1	J2	J3	P2	J5	J7
CCC/ MAIN J5	TREND/ MUX J8			TB6 TB16 TB23	ALARM CRT KEYPAD

SIDE VIEW OF CRT ASSEMBLY

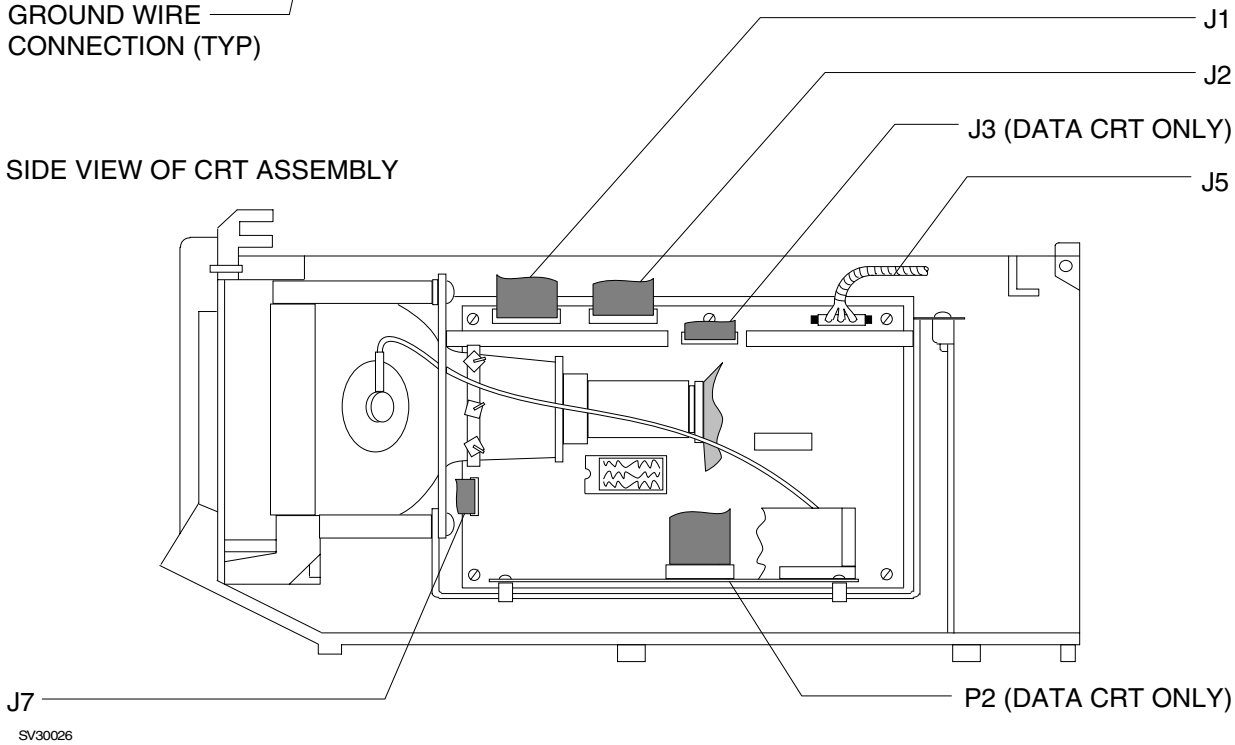


Figure 4-25: ALARM AND DATA CRT ASSEMBLIES

4.25.12 Carefully lower the replacement CRT assembly into place. For the alarm CRT, ensure that the alarm CRT keypad cable is routed properly.

4.25.13 Slide the CRT assembly forward, and reinstall the mounting screws and washers.

4.25.14 Connect the cables that were previously removed from J7, P2, J3, J1, J2, and J5 according to the cable destination schedule in the illustration.

4.25.15 Connect the ground wire.

4.25.16 Restore power to the machine and observe the display for correct size, centering, contrast, brightness and focus. Refer to the video adjustment procedure given in Section 5 if necessary.

4.25.17 Reinstall the top shelf on the monitor housing and re-connect its ground wire.

4.25.18 Close the monitor housing back cover and replace the retaining screws. Re-connect any external cables that were previously removed from the serial ports.

4.25.19 Perform the PMS Procedure given in Section 6.

4.26 Keypads

The data CRT, alarm CRT and system control keypads are held to the front bezel by self adhesive. Replacement of any keypad requires removal of the trend assembly, and removal of both CRT assemblies for access to the back of the bezel. Figure 4-26 shows the keypad cable and ground strap arrangement along with bezel assembly details.

4.26.1 Set the System Power switch to STANDBY and remove AC power from the machine.

4.26.2 Disconnect any external serial interface cables from the back of the monitor housing.

4.26.3 Remove the two monitor housing back cover retainer screws, and swing open the back cover.

4.26.4 Remove the top shelf from the monitor housing and disconnect its ground wire.

CAUTION: The trend assembly and the CRT assemblies contain static sensitive devices. Use ESD protection when handling these assemblies.

4.26.5 Disconnect all of the cables attached to the CRT assemblies, and remove both CRT assemblies. (Ref.: 4.25, CRT Assemblies)

4.26.6 Disconnect the cables attached to the trend assembly, and loosen its captive mounting screws. (Ref.: 4.23, Trend Assembly)

4.26.7 Remove the four screws holding the retainer plate to the back of the bezel, and remove the retainer plate.

4.26.8 Remove the screw from the system control keypad ground strap.

4.26.9 Carefully remove the filter panel with the system control keypad from the back of the bezel.

4.26.10 For replacement of the system control keypad, carefully separate the keypad from the filter panel and install a new keypad in its place.

For replacement of the CRT keypads, remove the ground strap screw and carefully pry the keypad from the front of the bezel. Feed the replacement keypad ground strap and cable through the bezel openings, press the keypad into place and reinstall the ground strap screw.

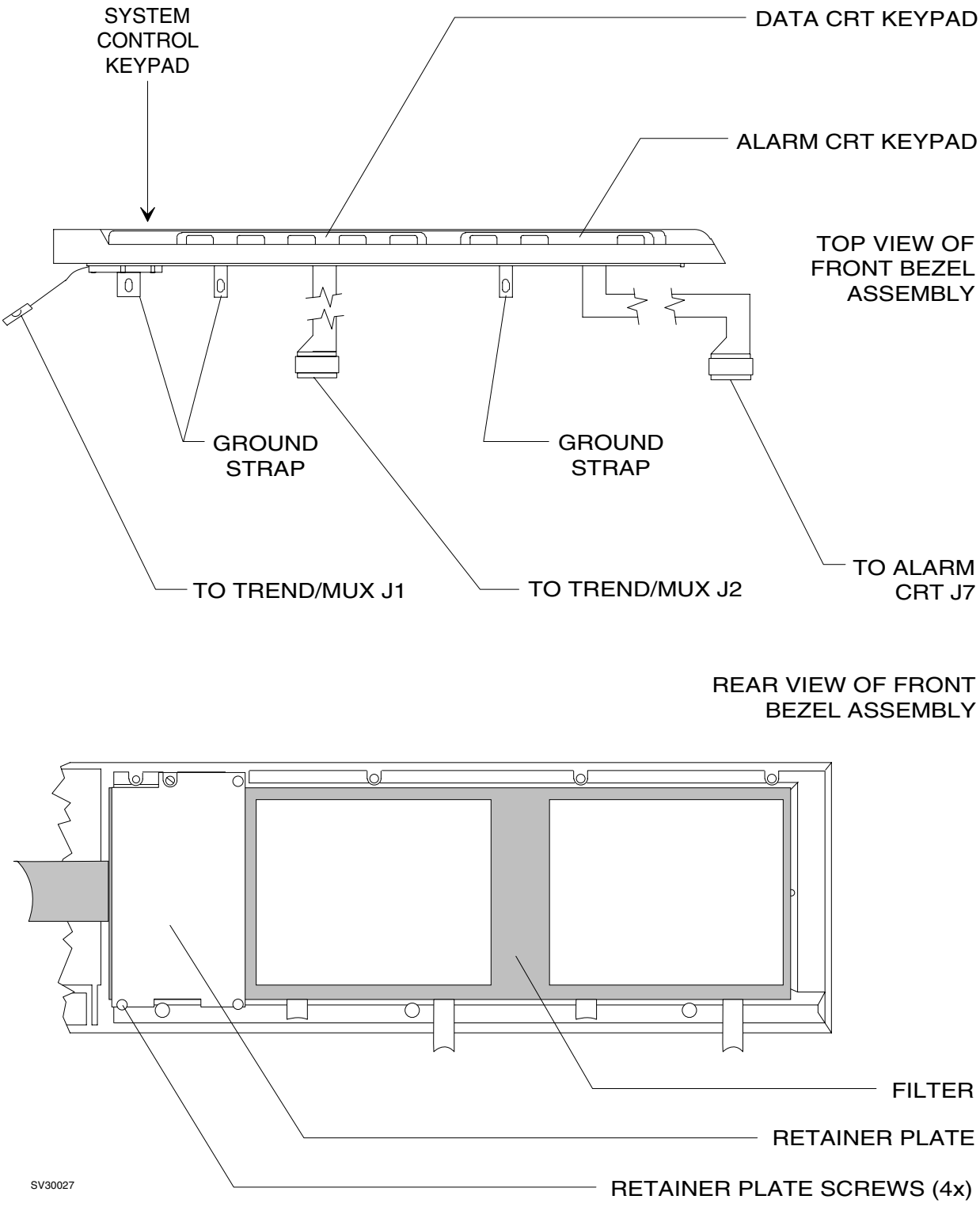


Figure 4-26: SYSTEM CONTROL AND CRT KEYPADS

4.26.11 Position the filter panel and system control keypad in the bezel, and reinstall the retainer plate and its four screws.

4.26.12 Reinstall the system control keypad ground strap screw.

4.26.13 Reinstall the trend assembly by connecting the cables that were previously removed, and securing the assembly to the monitor housing.

4.26.14 Reinstall the CRT assemblies in the monitor housing, and connect the cables that were previously removed.

4.26.15 Reinstall the top shelf on the monitor housing and re-connect its ground wire.

4.26.16 Close the monitor housing back cover and replace the retaining screws. Re-connect any external cables that were previously removed from the serial ports.

4.26.17 Perform the PMS Procedure given in Section 6.

4.27 Pulse Oximeter Module

The Pulse Oximeter Module is located in the right side of the ventilator box. Access to the module requires removal of the ventilator box front panel. Figure 4-27 shows the pulse oximeter module mounting arrangement and connections.

4.27.1 Set the System Power switch to STANDBY and remove AC power from the machine.

4.27.2 Remove the six screws holding the ventilator box front panel.

4.27.3 Carefully remove the ventilator box front panel and separate the ventilator switch in-line connector.

4.27.4 Remove the two screws holding the pulse oximeter module to the floor of the ventilator box.

4.27.5 Disconnect the power, sensor interface, and monitor cables, and remove the pulse oximeter module.

4.27.6 Position the replacement module in the ventilator box and connect the previously removed cables as follows:

J1 upper board (to SaO_2 monitor)
J2 upper board (power)
J2 lower board (from SaO_2 interface panel)

4.27.7 Secure the module to the floor of the ventilator box with the screws that were previously removed.

4.27.8 Carefully join the ventilator switch in-line connector, and reinstall the ventilator box front panel. Be sure that the drive pin on the inspiratory flow regulator is correctly aligned with the knob assembly.

4.27.9 Reinstall the six screws holding the ventilator box front panel.

4.27.10 Perform the PMS Procedure given in Section 6.

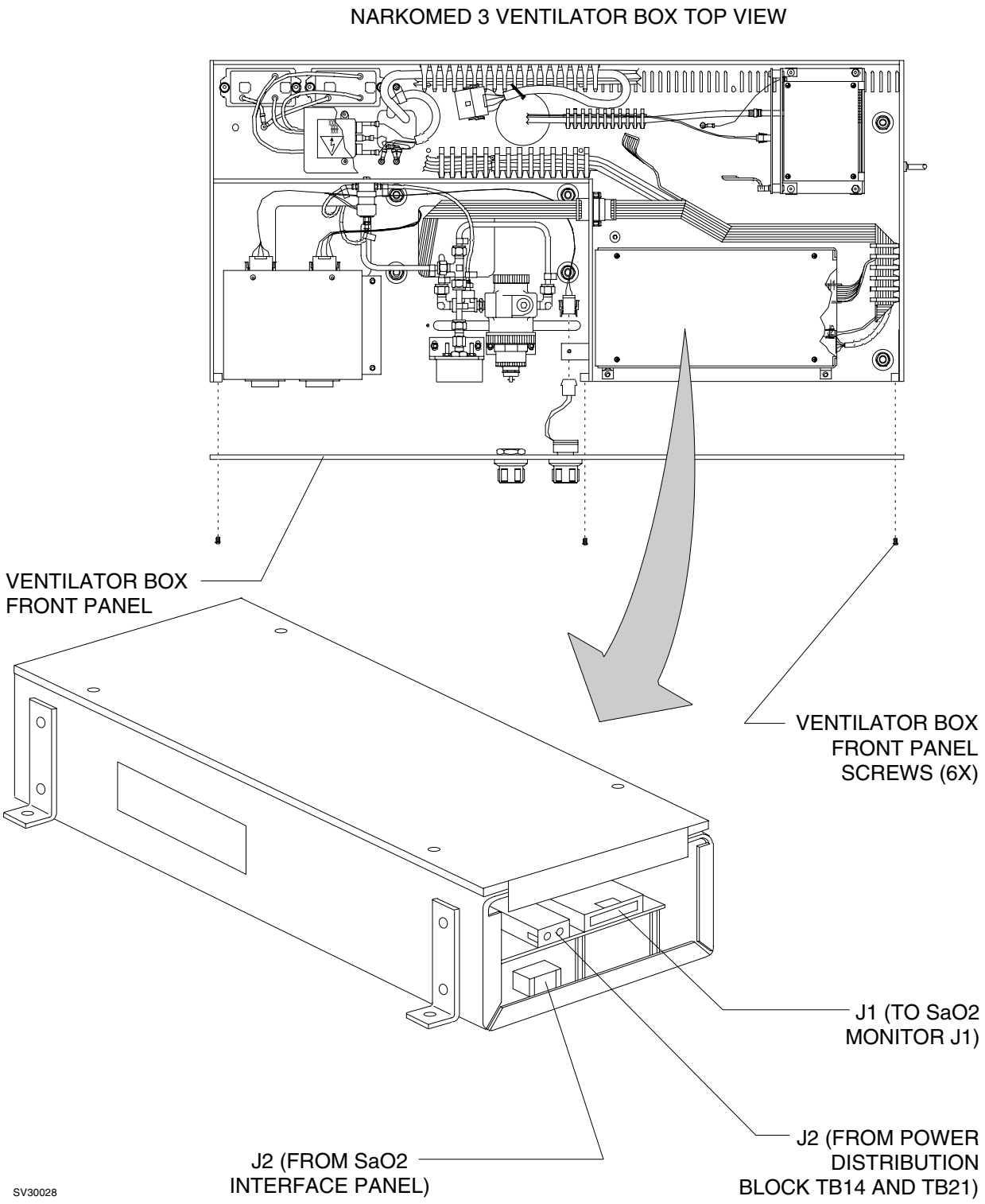


Figure 4-27: PULSE OXIMETER MODULE

4.28 Power Controller Assembly

The Power Controller Assembly is located at the back of the machine within the secondary power supply compartment. Access to the assembly requires removal of the compartment cover. Figure 4-28 shows the mounting arrangement and location of connections to the power controller assembly.

4.28.1 Set the System Power switch to STANDBY and remove AC power from the machine.

4.28.2 Disable the three circuit breakers located on the side of the primary power supply assembly by pulling out each button with a knife or sharp object.

4.28.3 Remove the eight screws holding the secondary power supply cover, and remove the cover.

4.28.4 Disconnect the cables from J1, J7, J3, J4, J5, and J6 on the power controller assembly.

4.28.5 Disconnect the ground wire.

4.28.6 Remove the four mounting screws and washers holding the power controller assembly, and remove the assembly from the compartment.

4.28.7 Mount the replacement power controller assembly in the compartment with the four screws and washers that were previously removed.

4.28.8 Connect the ground wire to the assembly.

4.28.9 Connect the previously removed cables to the following points on the power controller assembly:

J6 (to power distribution block in monitor housing)
J5 (to power distribution block in monitor housing)
J4 (from primary power supply P7)
J3 (from primary power supply P19)
J7 (to alarm channel connector J4)
J1 (from primary power supply P6)

4.28.10 Reinstall the secondary power supply compartment cover with its eight retaining screws.

4.28.11 Reset the circuit breakers at the side of the primary power supply.

4.28.12 Perform the PMS Procedure given in Section 6.

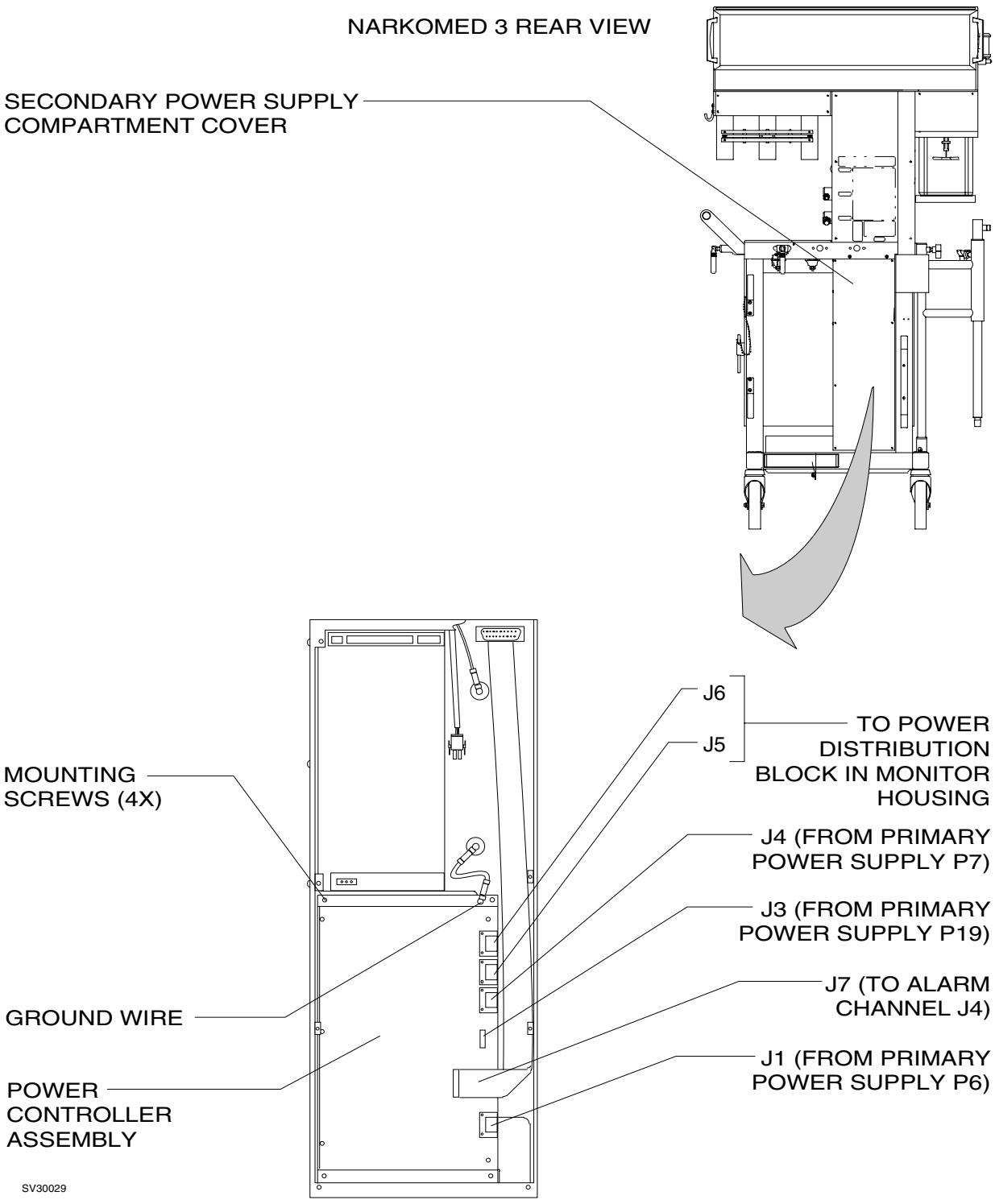


Figure 4-28: POWER CONTROLLER ASSEMBLY

4.29 Multispec Power Supply

The Multispec Power Supply is located at the back of the machine within the secondary power supply compartment. Access to the assembly requires removal of the compartment cover. Figure 4-29 shows the mounting arrangement and location of connections to the multispec power supply.

4.29.1 Set the System Power switch to STANDBY and remove AC power from the machine.

4.29.2 Disable the three circuit breakers located on the side of the primary power supply assembly by pulling out each button with a knife or sharp object.

4.29.3 Remove the eight screws holding the secondary power supply cover, and remove the cover.

4.29.4 Remove the ground connection.

4.29.5 Remove the three mounting screws at the side of the secondary power supply compartment, and pull the multispec power supply out far enough to gain access to its connections.

4.29.6 Disconnect the cables from J2, J3, and J4 on the power supply.

4.29.7 Separate the in-line AC power connector and remove the power supply.

4.29.8 Join the AC power cable to the in-line connector on the replacement multispec power supply.

4.29.9 Connect the previously removed cables to the following points on the replacement power supply:

J2 (to multispec analyzer PCB assembly J5 and J4)
J4 (to multispec analyzer PCB assembly J4)
J3 (to multispec analyzer PCB assembly J3)

4.29.10 Position the multispec power supply in the compartment and secure it with the three mounting screws through the side wall of the compartment.

4.29.11 Reinstall the secondary power supply compartment cover with its eight retaining screws.

4.29.12 Reset the circuit breakers at the side of the primary power supply.

4.29.13 Perform the PMS Procedure given in Section 6.

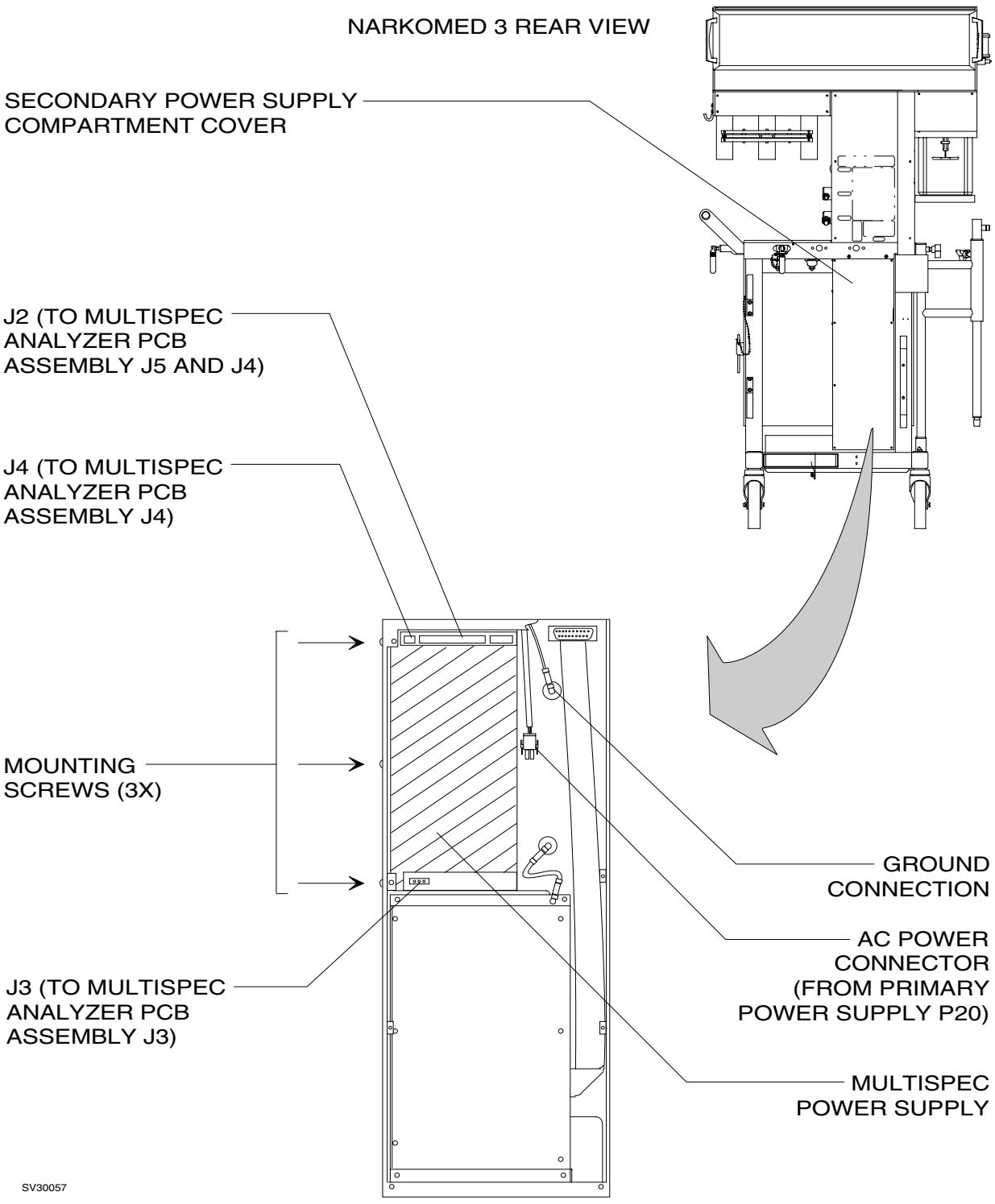

NARKOMED 3 REAR VIEW
SECONDARY POWER SUPPLY COMPARTMENT COVER
J2 (TO MULTISPEC ANALYZER PCB ASSEMBLY J5 AND J4)
J4 (TO MULTISPEC ANALYZER PCB ASSEMBLY J4)
MOUNTING SCREWS (3X)
J3 (TO MULTISPEC ANALYZER PCB ASSEMBLY J3)
GROUND CONNECTION
AC POWER CONNECTOR (FROM PRIMARY POWER SUPPLY P20)
MULTISPEC POWER SUPPLY
SV30057

Figure 4-29: MULTISPEC POWER SUPPLY

4.30 Primary Power Supply

The Primary Power Supply is located in the housing on the machine frame below the bottom drawer. It is accessible by removing the forward bottom panel on the housing, which is also the power supply mounting bracket. Figure 4-30 shows the mounting arrangement and terminal block connections to the primary power supply.

4.30.1 Set the System Power switch to STANDBY and remove AC power from the machine.

4.30.2 Disable the three circuit breakers located on the side of the primary power supply assembly by pulling out each button with a knife or sharp object.

4.30.3 Remove the four screws holding the forward bottom panel on the primary power supply housing, and lower the primary power supply to the floor.

4.30.4 Disconnect the control cable and terminal block wiring from the primary power supply.

4.30.5 Remove the seven screws holding the primary power supply to its mounting bracket, and remove the power supply.

4.30.6 Assemble the replacement power supply to the mounting bracket with the seven screws that were previously removed.

4.30.7 Connect the terminal block wiring and control cable to the replacement power supply.

4.30.8 Position the primary power supply in the housing and secure it with the four mounting screws that were previously removed.

4.30.9 Reset the circuit breakers at the side of the primary power supply.

4.30.10 Perform the PMS Procedure given in Section 6.

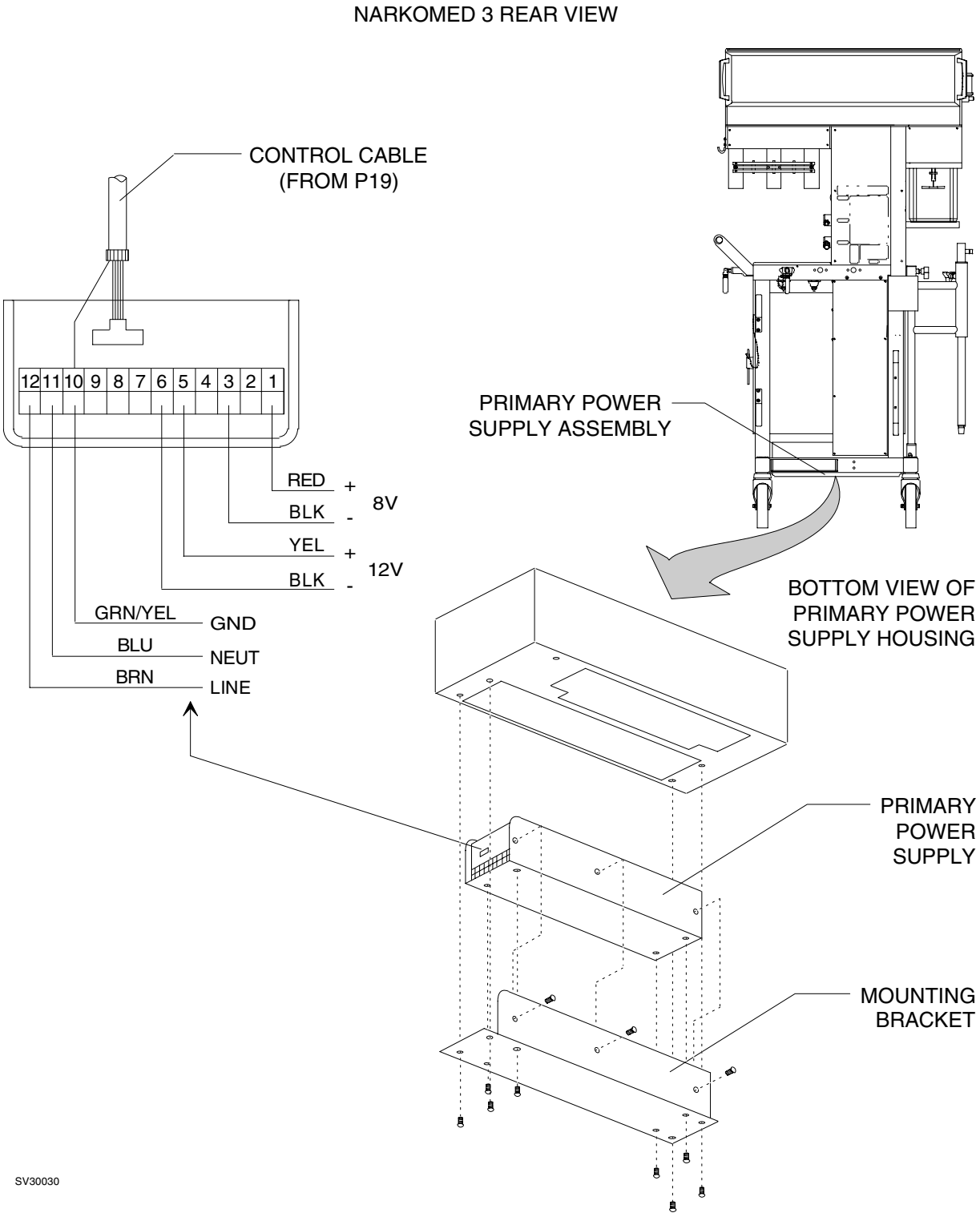


Figure 4-30: PRIMARY POWER SUPPLY

4.31 Battery Pack

The Battery Pack is located in the primary power supply housing on the machine frame below the bottom drawer. It is accessible by removing the rear bottom panel on the housing, which is also the bottom plate of the battery pack. Figure 4-31 shows the battery pack mounting arrangement and connection to the primary power supply.

4.31.1 Set the System Power switch to STANDBY and remove AC power from the machine.

4.31.2 Disable the three circuit breakers located on the side of the primary power supply assembly by pulling out each button with a knife or sharp object.

4.31.3 Remove the four screws holding the battery pack to the housing, and lower the battery pack to the floor.

4.31.4 Disconnect primary power supply cable P3 from the battery pack, and remove the battery pack.

4.31.5 Join the primary power supply cable to the connector on the replacement battery pack.

4.31.6 Position the battery pack in the primary power supply housing and secure it with the four screws that were previously removed.

4.31.7 Reset the circuit breakers at the side of the primary power supply.

4.31.8 Perform the PMS Procedure given in Section 6.

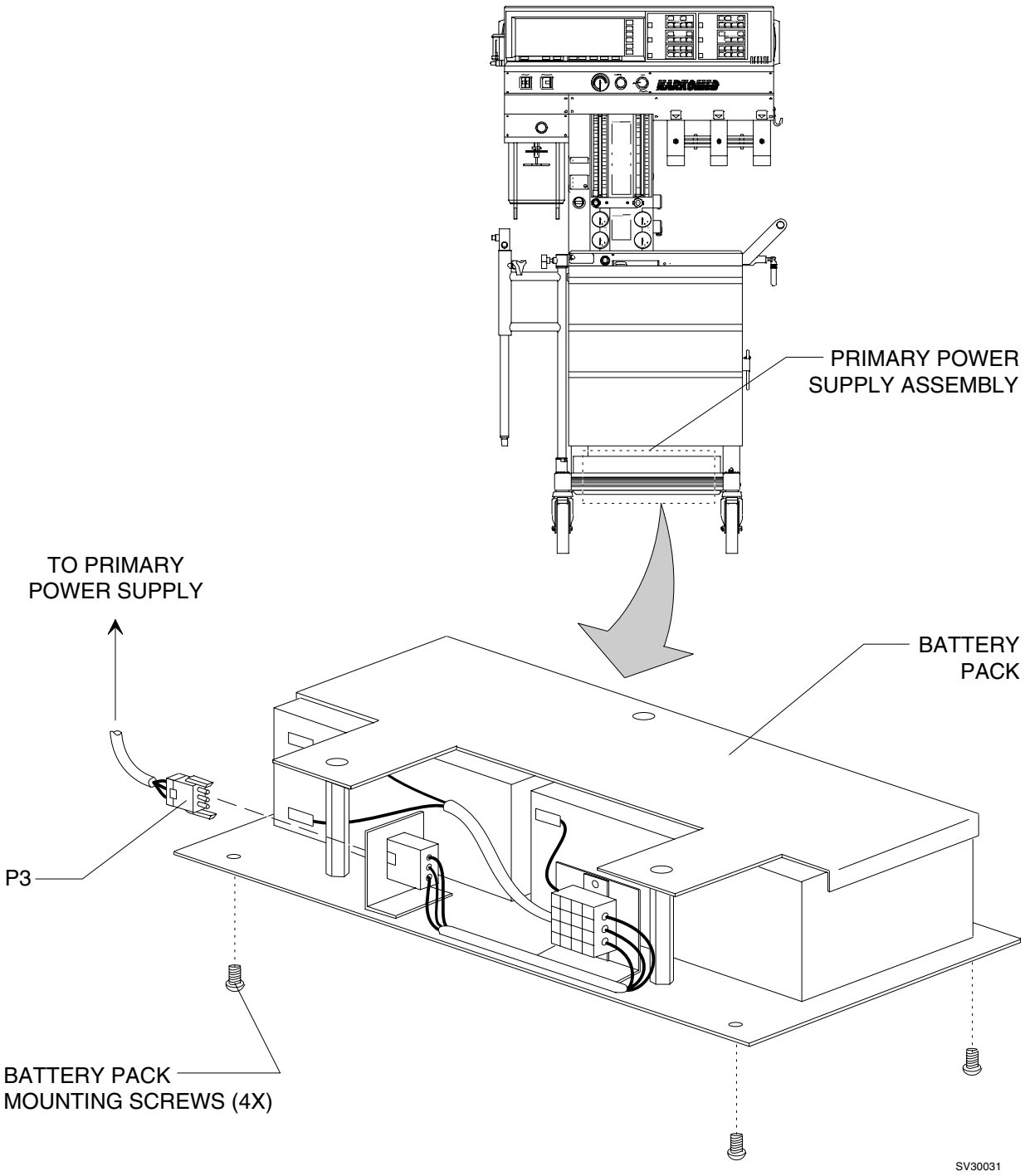


Figure 4-31: BATTERY PACK

4.32 Caster

Each caster is retained by a set screw in the side of the lower frame rail as shown in Figure 4-32. Caster replacement requires that the machine be tilted to provide enough clearance for the caster stem to be withdrawn from the bottom of the frame rail.

NOTE: Early model NARKOMED 3 machines may have casters that are threaded into the machine frame instead of having a set screw retainer arrangement.

WARNING: Do not tilt the machine more than 10 degrees or raise the casters more than 3½ inches from the floor. Failure to observe this precaution may result in a tip-over, causing personal injury. Vaporizers containing anesthetic agent may also be damaged.

4.32.1 Obtain a brace capable of supporting one side of the machine with its casters two to three inches from the floor.

4.32.2 Remove all unsecured equipment and accessories from the machine.

4.32.3 Lock the front casters.

4.32.4 Using at least two people, tilt the machine until the casters on one side are raised two to three inches from the floor, and position the support brace under the frame rail between the front and back casters.

For early model machines with threaded casters, follow steps 4.32.4.1 thru 4.32.4.4.

4.32.4.1 Unscrew the caster from the frame and clean any debris or loctite residue from the threads in the machine frame.

4.32.4.2 Thread the replacement caster into the machine frame, tighten the caster, and measure the gap between the caster and the machine frame with a 0.010" feeler gauge.

If the gap is zero or less than 0.010", remove the caster and proceed to Step 4.32.4.3.

If the gap is greater than 0.010", remove the caster and install a spacer on the caster.

4.32.4.3 Place a small amount of Loctite #222 (red) on the upper threads of the caster stem, thread the caster into the machine frame and tighten the caster.

4.32.4.4 Proceed to Step 4.32.9.

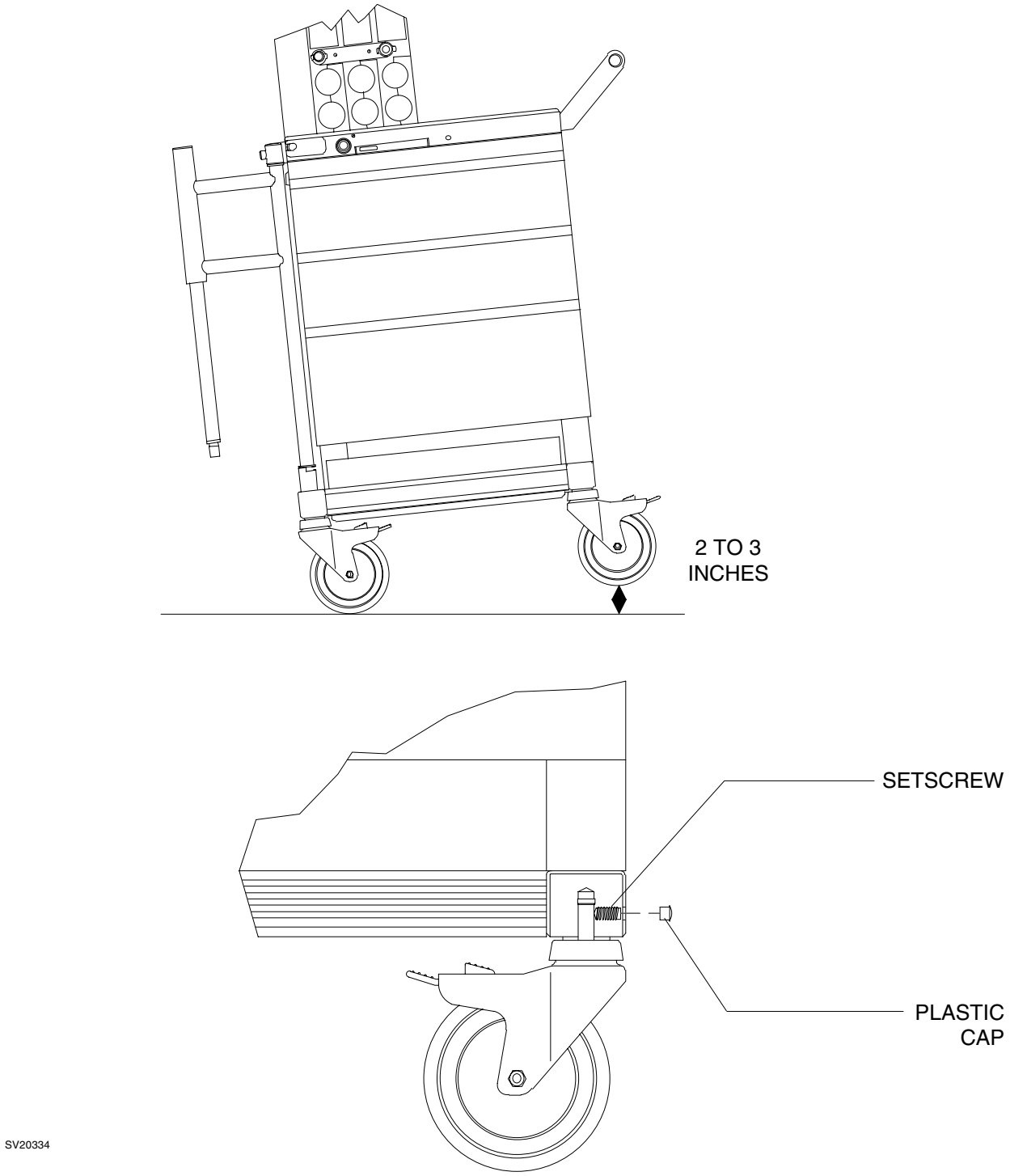


Figure 4-32: CASTER REPLACEMENT

4.32.5 Remove the plastic cap in the side of the frame rail to provide access to the caster stem set screw.

4.32.6 Loosen the set screw and remove the caster.

4.32.7 Insert the replacement caster into the frame and hold it in its seated position.

4.32.8 Tighten the caster stem set screw and replace the plastic cap in the frame rail.

4.32.9 Using at least two people, tilt the machine, remove the support brace and carefully lower the machine to the floor.

4.32.10 Check for proper operation of the caster and ensure that the front casters lock properly.

4.32.11 Replace any unsecured equipment and accessories that were previously removed.

4.32.12 Perform the PMS Procedure given in Section 6, including a vaporizer calibration verification.

4.33 SPIROMED Respiratory Volume Sensor

The respiratory volume sensor is installed between the top of the absorber assembly and the expiratory valve. Figure 4-33 shows the volume sensor mounting arrangement, gaskets and connection to the sensor interface panel.

4.33.1 Set the System Power switch to STANDBY.

4.33.2 Disconnect the sensor plug from the volume sensor receptacle on the interface panel.

4.33.3 Remove the expiratory valve by unscrewing the valve retaining nut.

4.33.4 Remove the volume sensor from the absorber assembly by unscrewing its retaining nut.

CAUTION: Do not twist the body of the sensor when loosening the retaining nut. Hold the sensor while loosening the retaining nut to prevent damage to the unit.

4.33.5 Install the replacement volume sensor on the absorber assembly. Ensure that the gasket is seated properly and hand tighten the retaining nut.

4.33.6 Install the expiratory valve on the sensor. Ensure that the gasket is seated properly and hand tighten the valve retaining nut.

4.33.7 Connect the sensor plug to the volume sensor receptacle on the interface panel.

4.33.8 Restore power to the machine and perform the respiratory flow monitor calibration procedure given in Section 5.

4.33.9 Perform the PMS Procedure given in Section 6.

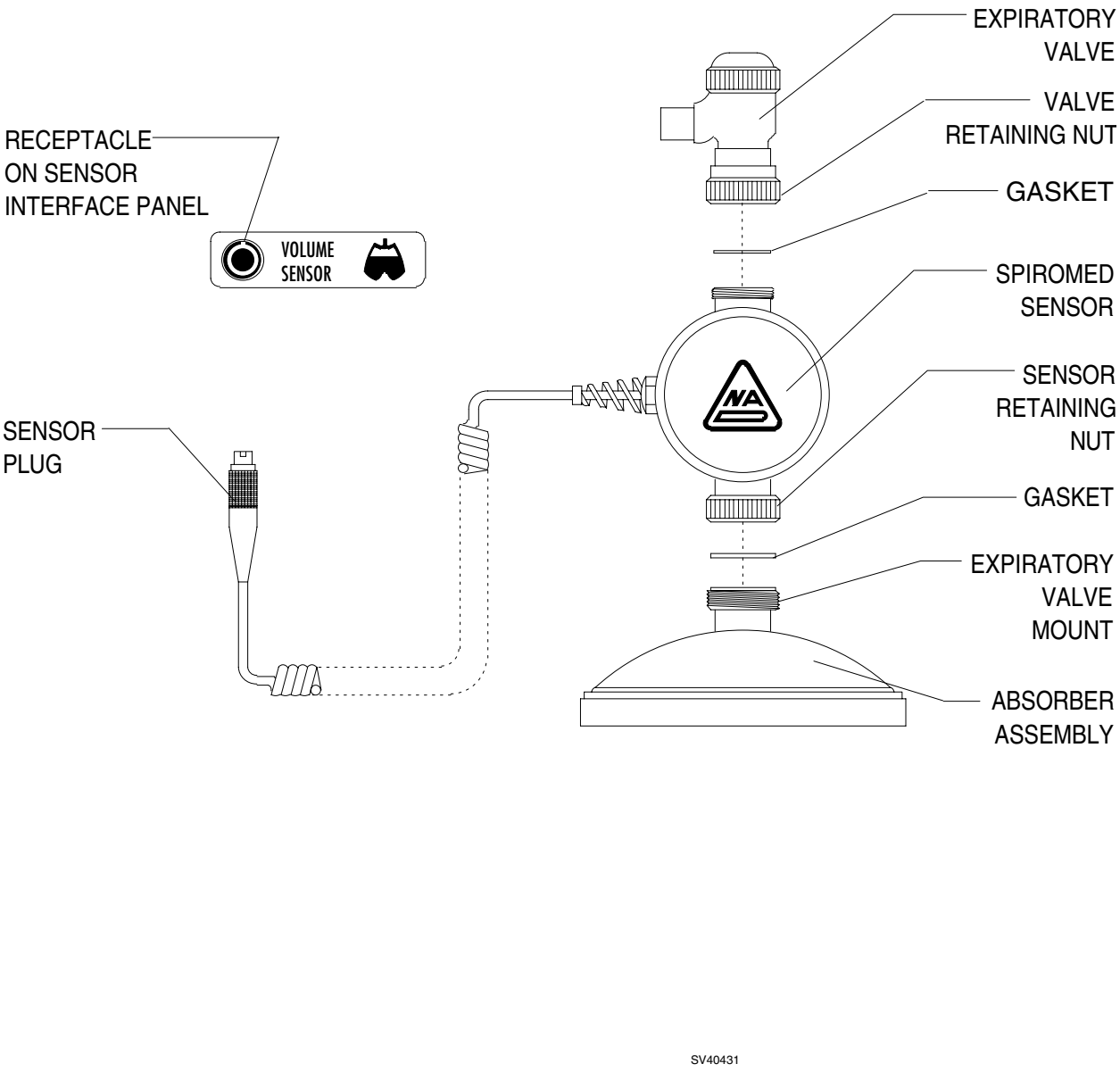


Figure 4-33: RESPIRATORY VOLUME SENSOR

4.34 Oxygen Sensor

The oxygen sensor is located on top of the inspiratory valve. Figure 4-34 shows the arrangement of the sensor capsule and its housing, and also its connection to the sensor interface panel.

4.34.1 Set the System Power switch to STANDBY.

4.34.2 Pull the oxygen sensor housing from the inspiratory valve dome. (It is a press fit.)

4.34.3 Unscrew the cover from the sensor housing and remove the sensor capsule.

4.34.4 Remove the replacement sensor capsule from its shipping container and install it in the housing. Ensure that the copper rings on the capsule mate with the electrical contacts in the sensor housing.

4.34.5 Wait 15 minutes to allow the sensor capsule to stabilize.

4.34.6 Restore power to the machine and perform the ambient air calibration procedure for the oxygen monitor given in Section 5.

4.34.7 Press the sensor assembly into the inspiratory valve dome.

4.34.8 Perform the PMS Procedure given in Section 6.

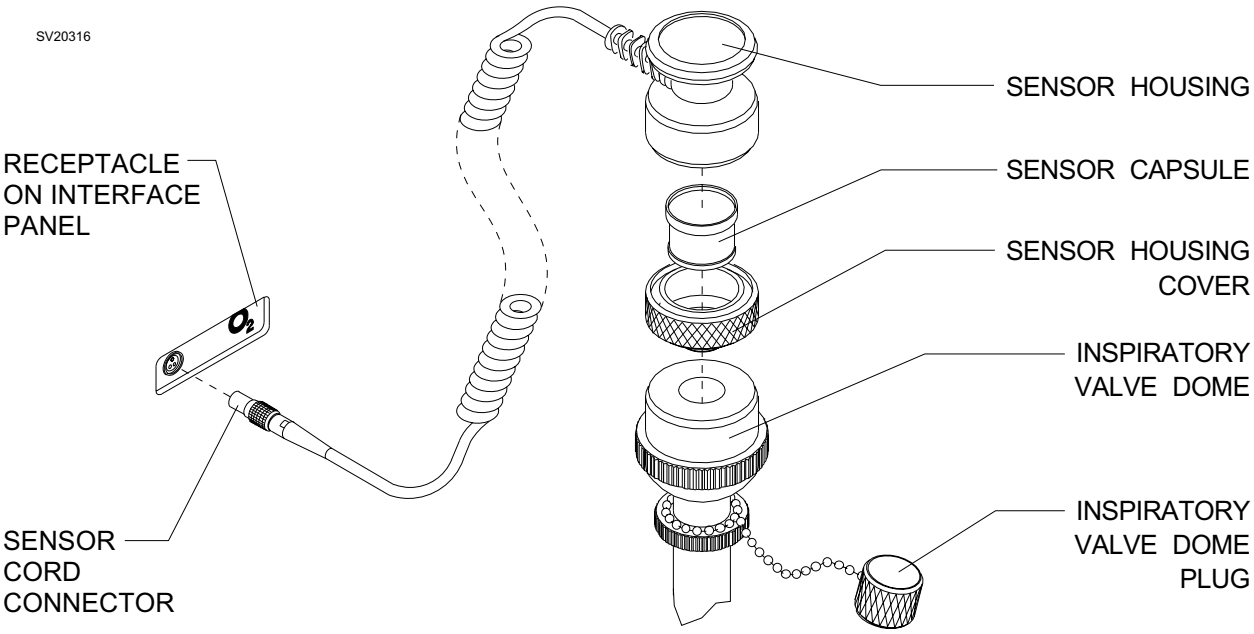


Figure 4-34: OXYGEN SENSOR REPLACEMENT

4.35 Manual Sphygmomanometer

The manual sphygmomanometer gauge is mounted on a threaded piece attached to the underside of the boom arm mounting block. Figure 4-33 shows the gauge mounting arrangement, and the gauge connection to the patient interface panel.

4.35.1 Disconnect the gauge line from the BP GAUGE fitting on the patient interface panel.

4.35.2 Remove the gauge by unscrewing its mounting ring from the fitting on the boom arm mounting block.

4.35.3 Install the replacement gauge on the threaded fitting on the boom arm mounting block, and hand tighten the gauge mounting ring.

4.35.4 Connect the gauge line to the BP GAUGE fitting on the patient interface panel.

4.35.5 Ensure that the remaining connections are properly made:

Connect the hose on the blood pressure cuff to an extension hose, and the other end of the extension hose to the BP CUFF fitting on the patient interface panel.

Connect the inflation bulb hose to the BP BULB fitting on the front of the machine.

4.35.6 Perform the following leak test on the manual sphygmomanometer:

4.35.6.1 Place the blood pressure cuff around a rigid cylindrical object approximately the same diameter as a human arm.

4.35.6.2 Inflate the cuff to a pressure of 200 mm Hg, as indicated on the gauge.

4.35.6.3 The pressure should not drop more than 10 mm Hg in 30 seconds.

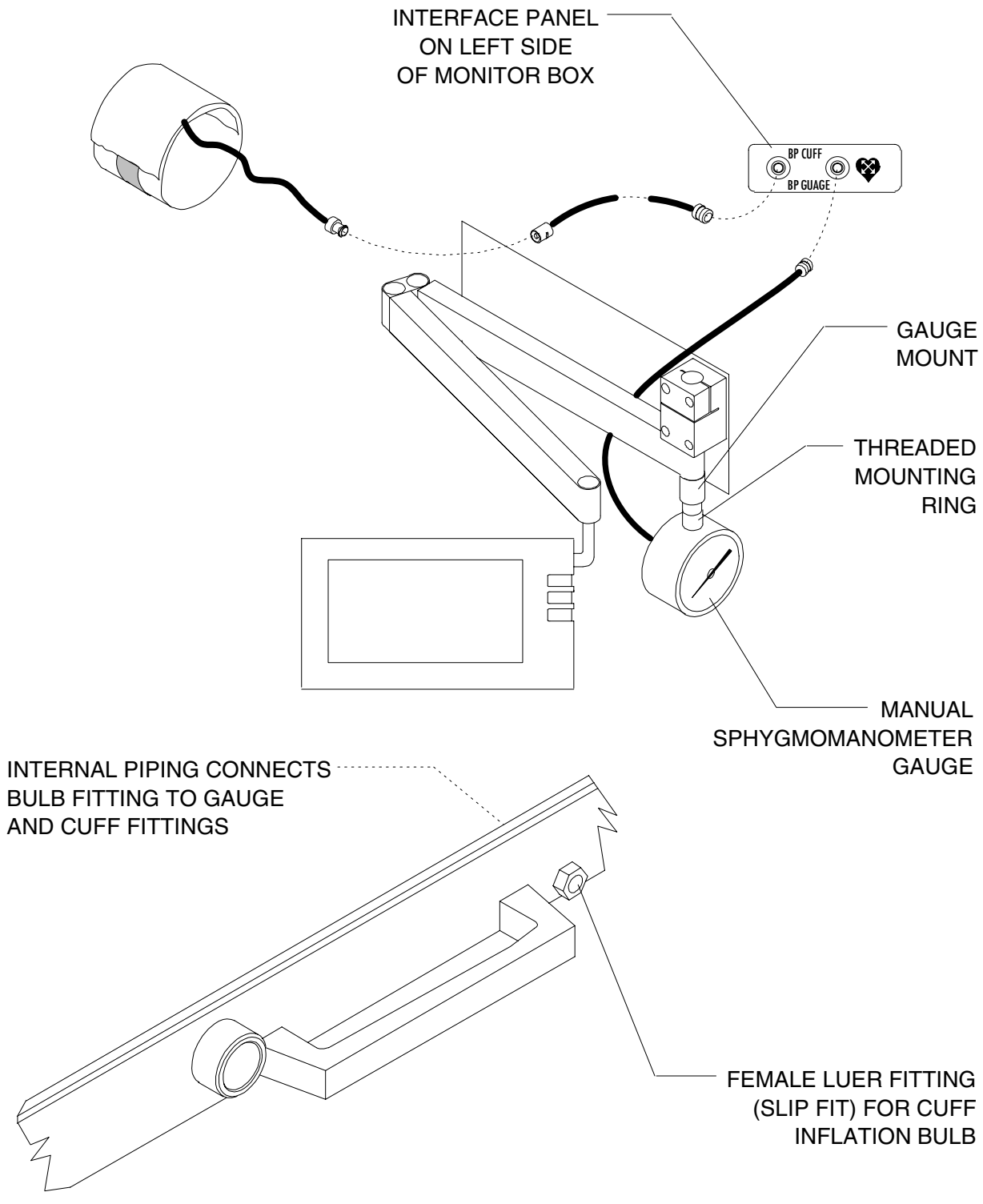


Figure 4-35: MANUAL SPHYGMOMANOMETER

4.36 Auxiliary Oxygen Flow Meter

Old and new style auxiliary oxygen flowmeters are attached to the side of the machine's flowmeter housing by two screws - accessible from inside the housing. Later installations of the new style auxiliary oxygen flowmeter have a stud and nut arrangement for mounting. A flexible O_2 supply tube from the flowmeter connects to a hose barb fitting at the system power switch. Figure 4-35 shows a typical mounting and tubing arrangement.

4.36.1 Disconnect all pipeline hoses and close all cylinder valves.

4.36.2 Press the O_2 Flush button to drain oxygen pressure from the system.

4.36.3 Turn the System Power switch to STANDBY and remove AC power from the machine.

4.36.4 Remove the back cover from the flowmeter housing.

4.36.5 Cut the tie strap on the flexible tube at the system power switch, and remove the tube.

4.36.6 Remove the screws (or nuts) securing the auxiliary O_2 flowmeter, and remove the flowmeter.

4.36.7 Position the replacement flowmeter at the side of the flowmeter housing (feed the flex tubing through the clearance hole) and secure the auxiliary O_2 flowmeter with the two screws (or nuts) that were previously removed.

4.36.8 Connect the flex tubing to the hose barb fitting behind the Clippard valve, and secure it with a tie strap.

4.36.9 Reinstall the flowmeter housing back cover.

4.36.10 Connect the pipeline hoses and restore AC power to the machine.

4.36.11 Perform the PMS Procedure given in Section 6.

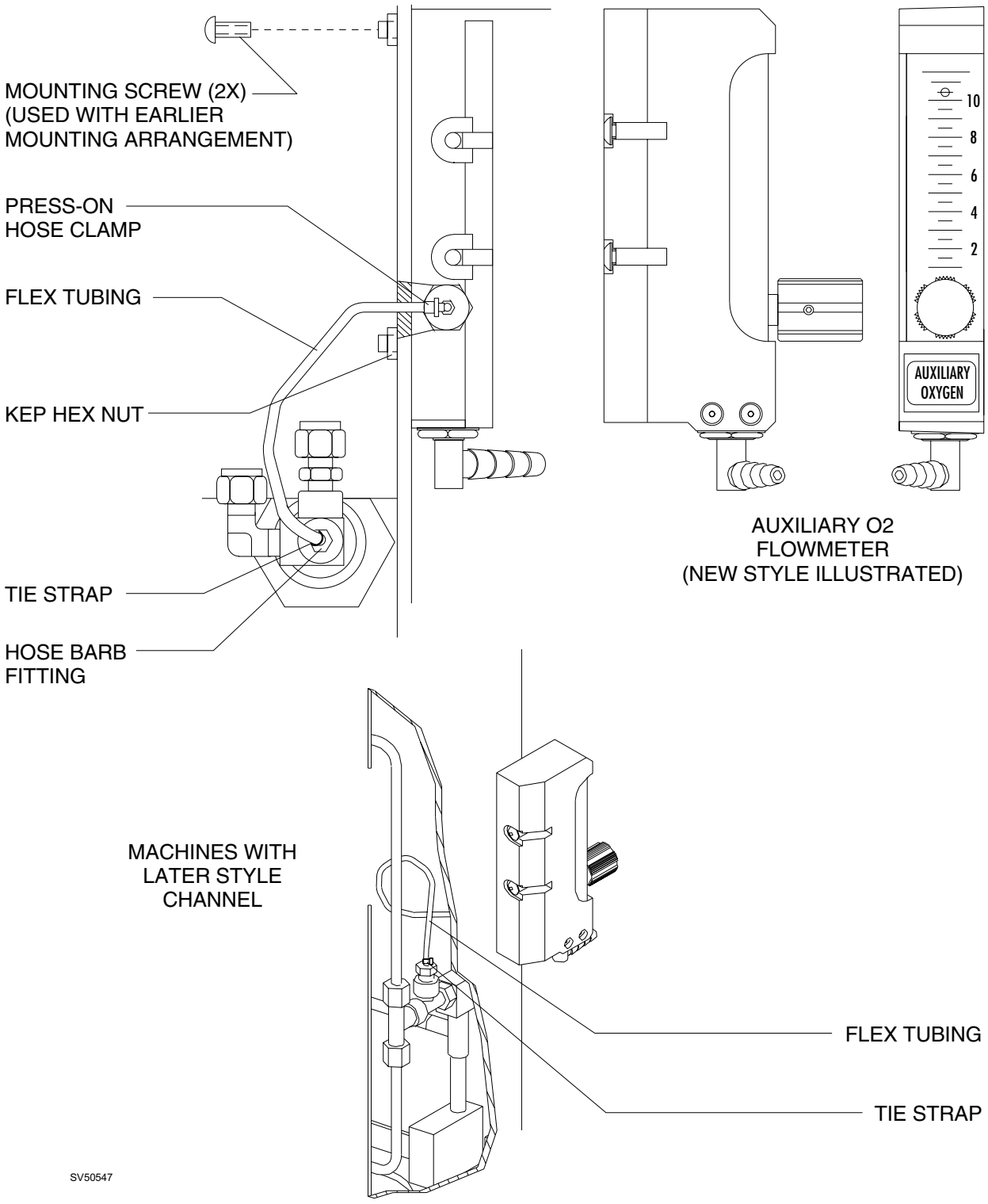


Figure 4-36: AUXILIARY O_2 FLOWMETER

4.37 PEEP Valve Magnet Assembly Replacement

The PEEP valve magnet assembly removal and replacement is outlined in the following procedure. Figure 4-33 shows the knob and magnet assembly details.

NOTE: Some older PEEP valve assemblies require the use of a tamper-proof 5/56 hex key (P/N S010056).

4.37.1 Loosen the two set screws on the block, at each side of the PEEP knob using a 5/64 hex key. Back these screws out until they are flush with the block to allow proper removal of the knob assembly.

4.37.2 Using a flat head screw driver, carefully pry the knob and magnet assembly away from the block, and remove the assembly.

4.37.3 Remove the four or six screws securing the retaining ring on the knob and magnet assembly, and remove the retaining ring.

4.37.4 Remove the magnet assembly from the knob and discard the magnet in an appropriate manner.

4.37.5 Insert the new magnet assembly into the knob.

On new style knobs, make sure the magnet's dowel pin engages the slots in the knob. If the magnet is not oriented correctly there will be freeplay in the knob before it turns the magnet.

4.37.6 Reinstall the retaining ring and secure it with the screws that were previously removed.

4.37.7 Turn the set screws into the PEEP block until you can just see them from the inside of the block.

4.37.8 Apply a thin coat of high vacuum grease to the O-rings on the magnet assembly to aid in its installation.

4.37.9 Align the holes of the magnet assembly with the set screw holes, and install the knob & magnet assembly into the PEEP block.

4.37.10 Slowly tighten the set screws. If the holes are lined up correctly. you will be able to tighten the set screws several turns until they stop. If you experience resistance, STOP tightening the set screw to prevent damage to the magnet assembly. Re-align the magnet assembly and tighten the set screw correctly.

4.37.11 Perform the PMS procedure given in Section 6.

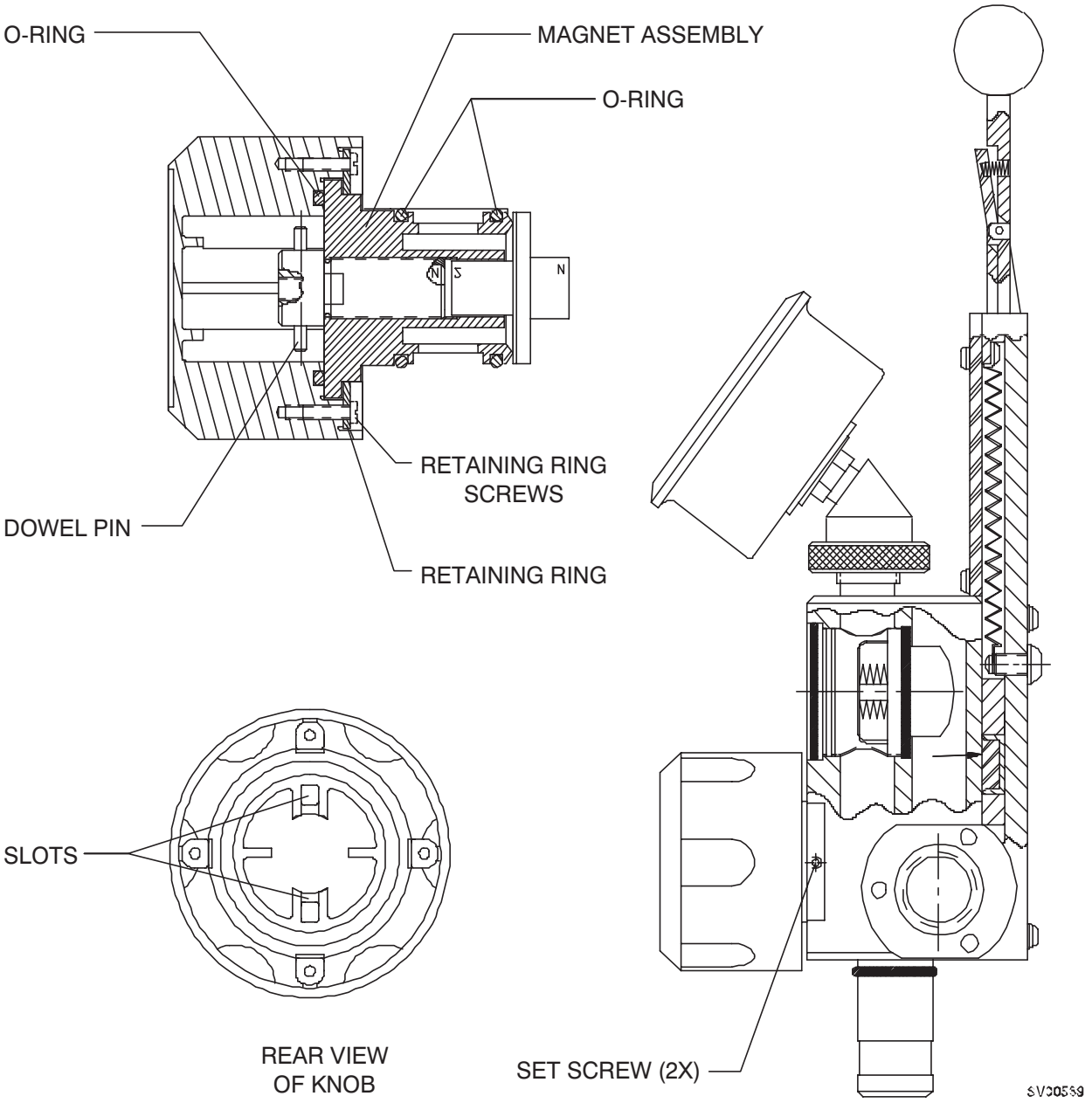


Figure 4-37: PEEP Valve Magnet Assembly Replacement

RETURN TO THIS MANUAL'S TABLE OF CONTENTS
RETURN TO CD-ROM TABLE OF CONTENTS

5.0 ADJUSTMENT AND CALIBRATION PROCEDURES

Equipment Required:

-- Test Gauge for setting cylinder pressure regulators,
NAD Part No. S000063A

-- Oxygen Monitor for adjusting oxygen ratio controller

-- Calibration Gas Adapter, NAD Part No. 4110716

-- Calibration Gas Cylinder, NAD Part No. 4110599 or 41100599-001

-- Certified sample gas cylinder for Multispec accuracy check

-- Flowmeter Test Stand, NAD Part No. S000058

-- Test fixture with breathing pressure line connector, TEE connector, digital pressure meter, and inflation device, for breathing pressure monitor calibration.

-- For machines with a Capnomed monitor:
Calibration Gas Cylinder, NAD Part No. 4107979 or 4107979-001
Calibration Gas Adapter, NAD Part No. 4110216

5.1 Cylinder Pressure Regulator Adjustment (except CO2)

5.1.1 Disconnect all pipeline hoses and set the System Power switch to ON.

5.1.2 Close all cylinder valves except the O_2 valve.

5.1.3 Set the oxygen flow to 4 liters per min.

5.1.4 Open the other gas flow control valves to drain pressure from the system.

5.1.5 Close the O2 cylinder valve. Close all of the flow control valves and press the O_2 Flush valve to drain oxygen pressure from the system.

5.1.6 Set the System Power switch to STANDBY.

5.1.7 Remove the table top from the machine and remove the top cabinet drawer. Pull the writing tray out out to its fully extended position.

NOTE: Minimum cylinder pressures for this adjustment shall be:
N2O & CO2: 600 psi; O2, Air, He, He/O2, N2: 1000 psi.

5.1.8 Locate the TEE fitting in the ¼ in. diameter regulator output line, and remove the plug from the TEE fitting.

5.1.9 Connect a test gauge to the TEE fitting.

NOTE: For gases other than O2, the O2 cylinder valve must be open to allow other gases to flow. For N2O regulator adjustment, open the N2O flow control valve completely; then open the O2 flow control valve until the N2O flow reaches 4 L/min.

5.1.10 Open the cylinder valve and set the System Power switch to ON.

5.1.11 Set the O2 flow to 4 L/min. (also set the N20 or other gas flow to 4 L/min. if these regulators are being adjusted).

5.1.12 Remove the acorn nut on the bottom of the regulator to expose the adjusting screw. For N2O, turn the screw until the test gauge indicates 46 psi. (50 psi for CSA machines.) For O2 and other gases, use the compensated regulator output setting based on the cylinder pressure given in the following table.

CAUTION: Based on information supplied by the cylinder regulator manufacturer, when the regulator is used for gases other than N2O or CO2, its output pressure will decrease 0.5 psi for every 100 psi increase in cylinder pressure above 1000 psi. Currently, these regulators are calibrated at 47 psi with a cylinder supply of 1000 psi. If a 2000 psi cylinder is then installed, the regulator output will be 42 psi. This change in output must be compensated for to provide accurate performance throughout the cylinder's working range.

NOTE: Cylinder pressure compensation for the N2O regulator is not required.

Cylinder Pressure (psi)	Compensated Regulator Output Setting (psi)	Compensated Regulator Output Tolerances (-4, +2)
2000	42 (*45)	38 - 44 (*41 - 47)
1800	43 (*46)	39 - 45 (*42 - 48)
1600	44 (*47)	40 - 46 (*43 - 49)
1400	45 (*48)	41 - 47 (*44 - 50)
1200	46 (*49)	42 - 48 (*45 - 51)
1000	47 (*50)	43 - 49 (*46 - 52)

* Canada Settings

NOTE: If the O2 cylinder regulator is adjusted according to the chart, perform the following test to verify that the Lo O2 supply alarm is not activated during ventilation.

Open the O2 cylinder valve, install a breathing circuit with test lung to absorber, and make the following settings:

MAN/AUTO selector to AUTO

Ventilator:
FREQUENCY: 10 BPM
I:E Ratio: 1:2
Tidal Volume: 1400 mL
PLC: MAX
INSP FLOW: HIGH

Set the Fresh Gas flow to 10 L/min.

Turn on the ventilator. While the ventilator is cycling, press the O2 flush button and verify that the Lo O2 Supply alarm is not activated. If the alarm is activated, refer to Section 5.2 for Oxygen Supply Pressure Alarm Switch Adjustment.

5.1.13 Replace the acorn nut on the bottom of the regulator.

5.1.14 Close the cylinder valve and allow pressure to drain from the system.

5.1.15 Close all of the flow control valves and set the System Power switch to STANDBY.

5.1.16 Disconnect the test gauge from the TEE fitting and replace the plug in the fitting.

5.1.17 Replace the table top and its retaining screws.

5.1.18 Replace the top drawer in the cabinet.

5.1.19 Connect the pipeline hoses.

5.1.20 Perform the PMS Procedure given in Section 6.

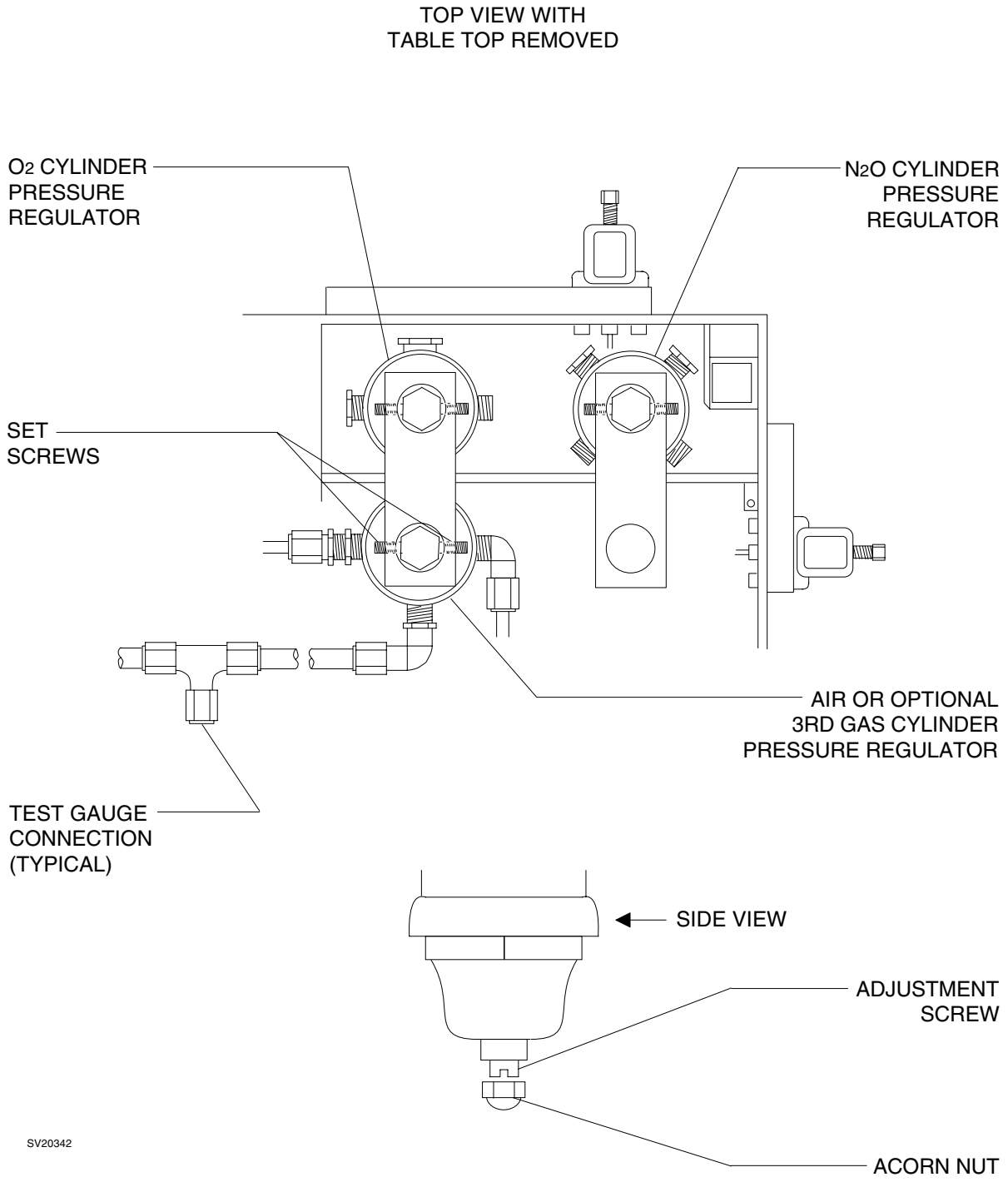


Figure 5-1: CYLINDER PRESSURE REGULATOR ADJUSTMENT

5.1A CO2 Cylinder Pressure Regulator Adjustment

5.1.1.A Perform Steps 5.1.1 thru 5.1.7.

5.1.2.A Open the CO_2 cylinder valve and set the System Power switch to ON.

5.1.3.A Fully open the CO_2 flow control valve.

5.1.4.A Remove the acorn nut on the bottom of the CO_2 regulator to expose the adjusting screw. Turn the screw until the CO_2 flowmeter indicates 550 ml/min.

5.1.5.A Replace the acorn nut on the bottom of the regulator.

5.1.6.A Close the cylinder valve and allow pressure to drain from the system.

5.1.7.A Close the flow control valve and set the System Power switch to STANDBY.

5.1.8.A Replace the table top and its retaining screws.

5.1.9.A Replace the top drawer in the cabinet.

5.1.10.A Connect the pipeline hoses.

5.1.11.A Perform the PMS Procedure given in Section 6.

5.2 Oxygen Supply Pressure Alarm Switch Adjustment

5.2.1 Disconnect all pipeline hoses and set the System Power switch to ON.

5.2.2 Close all cylinder valves except the O_2 valve.

5.2.3 Set the oxygen flow to 5 liters per min.

5.2.4 Open the other gas flow control valves to drain pressure from the system.

5.2.5 Close the O_2 cylinder valve, and close the flow control valves. Press the O_2 Flush valve to drain oxygen pressure from the system.

5.2.6 Set the System Power switch to STANDBY.

5.2.7 Remove the rear cover from the machine. Remove the table top and remove the top cabinet drawer. Refer to replacement procedure 4.8.

5.2.8 Locate the TEE fitting in the ¼ in. diameter regulator output line, and remove the plug from the TEE fitting.

5.2.9 Connect a test gauge to the TEE fitting.

5.2.10 Open the O_2 cylinder valve and set the System Power switch to ON.

5.2.11 Set the oxygen flow to 5 liters per min.

5.2.12 Close the oxygen cylinder valve.

5.2.12 As the pressure drops, the O_2 SUPPLY alarm should activate when the pressure is between 40 and 34 psi as shown on the test gauge.

5.2.13 If the alarm activates when the pressure is below 34 psi, turn the adjustment wheel counter-clockwise, repeat the test and adjust as necessary to bring the set point into the correct range.

If the alarm activates when the pressure is above 40 psi, turn the adjustment wheel clockwise,repeat the test and adjust as necessary to bring the set point into the correct range.

REAR VIEW, FLOWMETER HOUSING
WITH REAR COVER REMOVED

SV40608

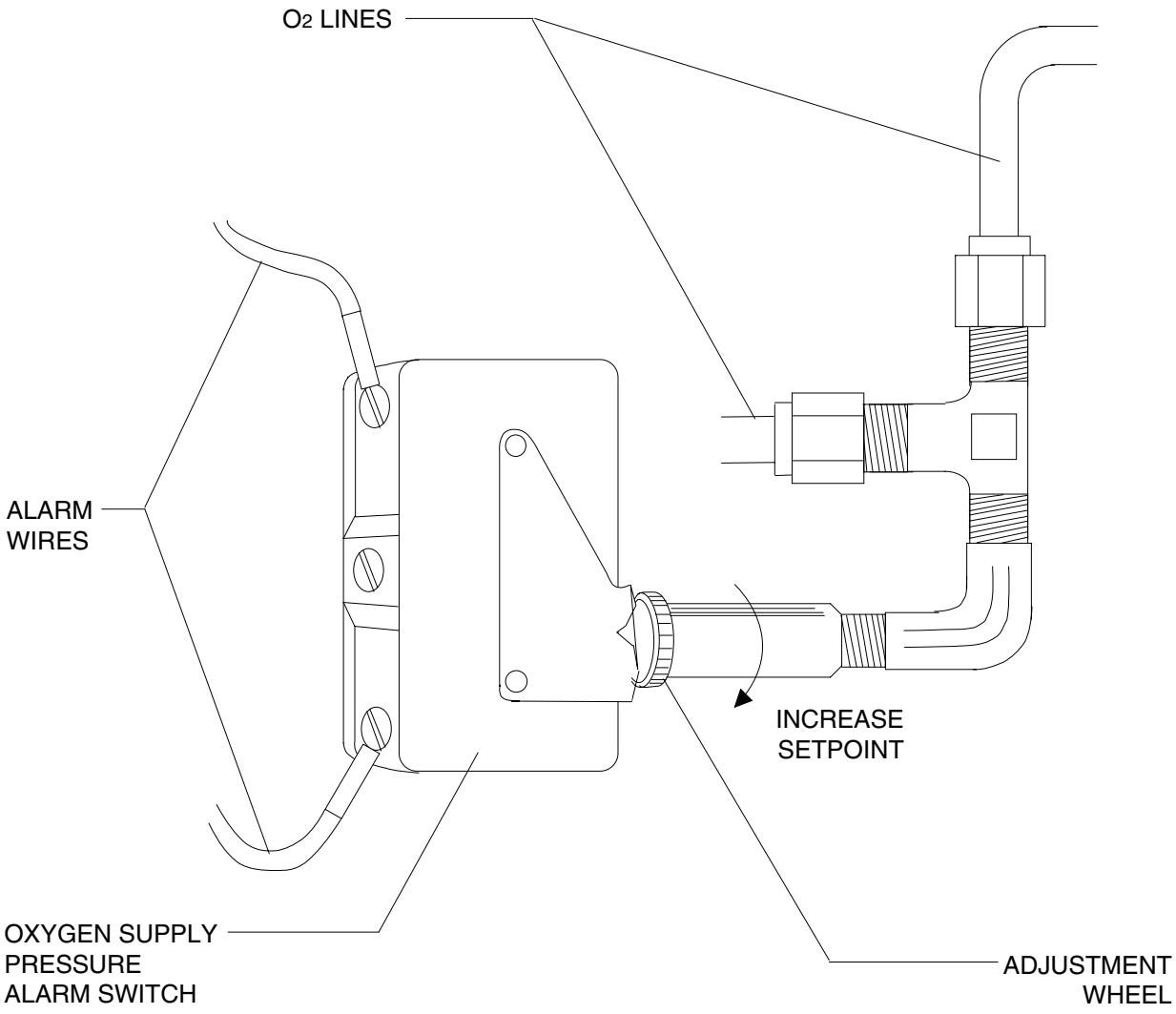


Figure 5-2: OXYGEN SUPPLY PRESSURE ALARM SWITCH

5.2.14 Set the System Power switch to STANDBY.

5.2.15 Disconnect the test gauge and replace the plug in the regulator line TEE fitting.

5.2.16 Replace the table top and its retaining screws.

5.2.17 Replace the rear cover and its retaining screws.

5.2.18 Connect the pipeline hoses.

5.2.19 Perform the PMS Procedure given in Section 6.

5.3 Oxygen Ratio Monitor/Controller Adjustment

5.3.1 Remove the rear cover of the vapor box. Refer to replacement procedure 4.10.

5.3.2 Connect a calibrated oxygen monitor to the Freshgas Outlet.

5.3.3 Disconnect the pipeline hoses.

5.3.4 Open the oxygen and nitrous oxide cylinder valves.

5.3.5 Set the System Power switch to ON.

5.3.6 Close the O_2 flow control valve.

5.3.7 Open the N_2O flow control valve to its counter-clockwise stop.

5.3.8 If there is no nitrous oxide flow, proceed to Step 5.3.10.

5.3.9 If there is nitrous oxide flow, loosen setscrew E and move the cam mounting bracket to the right until the nitrous oxide flow stops. Tighten setscrew E.

5.3.10 Slowly open the O_2 flow control valve.

5.3.11 If the nitrous oxide starts to flow when the oxygen flow is between 200 and 300 ml per minute, proceed to Step 5.3.14.

5.3.12 If the nitrous oxide does not start to flow when the oxygen flow is between 200 and 300 ml per minute, loosen setscrew E and move the cam mounting bracket to the left until nitrous oxide flow starts. Tighten setscrew E.

5.3.13 Repeat steps 5.3.6 thru 5.3.12 until no further adjustment of the cam mounting bracket is needed.

5.3.14 Adjust the oxygen flow to a point where the nitrous oxide flowmeter indicates 10 liters per minute.

NOTE: Steps marked with an asterisk (*) do not apply to later model machines that do not have the O_2/N_2O ratio lamp on the alarm channel.

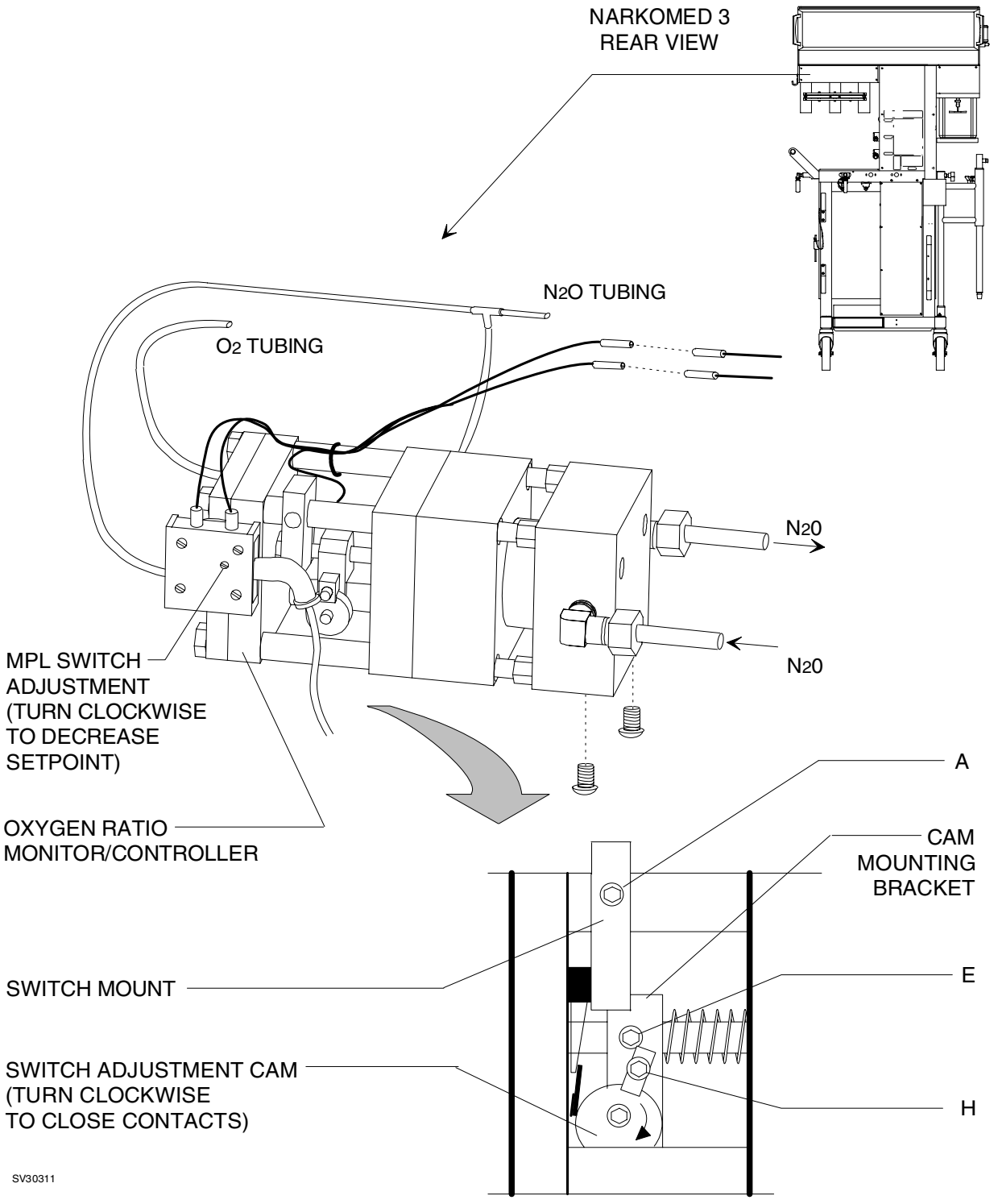


Figure 5-3: OXYGEN RATIO MONITOR/CONTROLLER ADJUSTMENTS

5.3.15 The oxygen concentration should be between 21% and 29% oxygen.

* 5.3.16 If the yellow O_2/N_2O FLOW RATIO lamp on the alarm panel is lighted, proceed to step 5.3.20.

* 5.3.17 If the yellow O_2/N_2O FLOW RATIO lamp on the alarm panel is not lighted, loosen setscrew H and turn the switch adjustment cam until it is pointing downward.

* 5.3.18 Loosen setscrew A and move the switch mount until it is nearly touching the switch adjustment cam. Tighten setscrew A.

* 5.3.19 Turn the switch adjustment cam clockwise until the contacts close and the O_2/N_2O FLOW RATIO lamp is lighted. Tighten setscrew H.

* 5.3.20 Close the N_2O flow control valve.

* 5.3.21 Adjust the oxygen flow to 1 liter per minute.

* 5.3.22 Slowly open the N_2O flow control valve.

* 5.3.23 The yellow O_2/N_2O FLOW RATIO lamp on the alarm panel should light as soon as the ORMC limits the flow of nitrous oxide.

* 5.3.24 Adjust the oxygen flow to 1.5 liters per minute.

* 5.3.25 Slowly open the N_2O flow control valve.

* 5.3.26 The yellow O_2/N_2O FLOW RATIO lamp on the alarm panel should light as soon as the ORMC limits the flow of nitrous oxide.

5.3.27 Adjust the oxygen flow to 2 liters per minute.

5.3.28 Slowly open the N_2O flow control valve.

* 5.3.29 The yellow O_2/N_2O FLOW RATIO lamp on the alarm panel should light as soon as the ORMC limits the flow of nitrous oxide.

5.3.30 Close the oxygen flow control valve. The nitrous oxide flow should decrease proportionally, and the oxygen concentration should remain between 21% and 29% oxygen.

5.3.31 The nitrous oxide flow should stop when the flow of oxygen is between 200 and 300 ml per minute.

* 5.3.32 If the O_2/N_2O FLOW RATIO lamp turns off when the nitrous oxide flow drops to between 100 and 200 ml per minute, proceed to Step 5.3.34.

* 5.3.33 If the O_2/N_2O FLOW RATIO lamp does not turn off when the nitrous oxide flow drops to between 100 and 200 ml per minute, adjust the MPL switch until the O_2/N_2O FLOW RATIO lamp turns off.

5.3.34 Close the O_2 cylinder valve and the O_2 flow control valve. Press the O_2 Flush valve to drain oxygen pressure from the system.

5.3.35 Close the N_2O flow control valve.

5.3.36 Reconnect the pipeline hoses.

5.3.37 Replace the rear cover of the vapor box.

5.3.38 Perform the PMS Procedure given in Section 6.

5.4 Oxygen Monitor Calibration

5.4.1 Offset Adjustment

5.4.1.1 Set the System Power switch to STANDBY.

5.4.1.2 Press and hold the [▼] and [▲] keys on the oxygen monitor panel, and turn the System Power switch to ON.

The display window should indicate [100] .

5.4.1.3 If the display indicates [100] , then no adjustment is required.

If the display does not indicate [100] , continue with the adjustment procedure.

5.4.1.4 Turn the System Power switch to STANDBY.

5.4.1.5 Disconnect any external serial interface cables from the back of the monitor housing.

5.4.1.6 Remove the two monitor housing back cover retainer screws, and swing open the back cover.

5.4.1.7 Remove the top shelf from the monitor housing and disconnect its ground wire.

5.4.1.8 Repeat Step 5.4.1.2.

5.4.1.9 Adjust R17 on the top of the monitor (see Figure 5-4) to bring the reading to [100] .

5.4.1.10 Place a small drop of red Glyptal insulating varnish on the adjustment screw to lock it in place.

5.4.1.11 Turn the System Power Switch to STANDBY and remove AC power from the machine.

5.4.1.12 Reinstall the top shelf on the monitor housing and re-connect its ground wire.

5.4.1.13 Close the monitor housing back cover and replace the retaining screws. Re-connect any external cables that were previously removed from the serial ports.

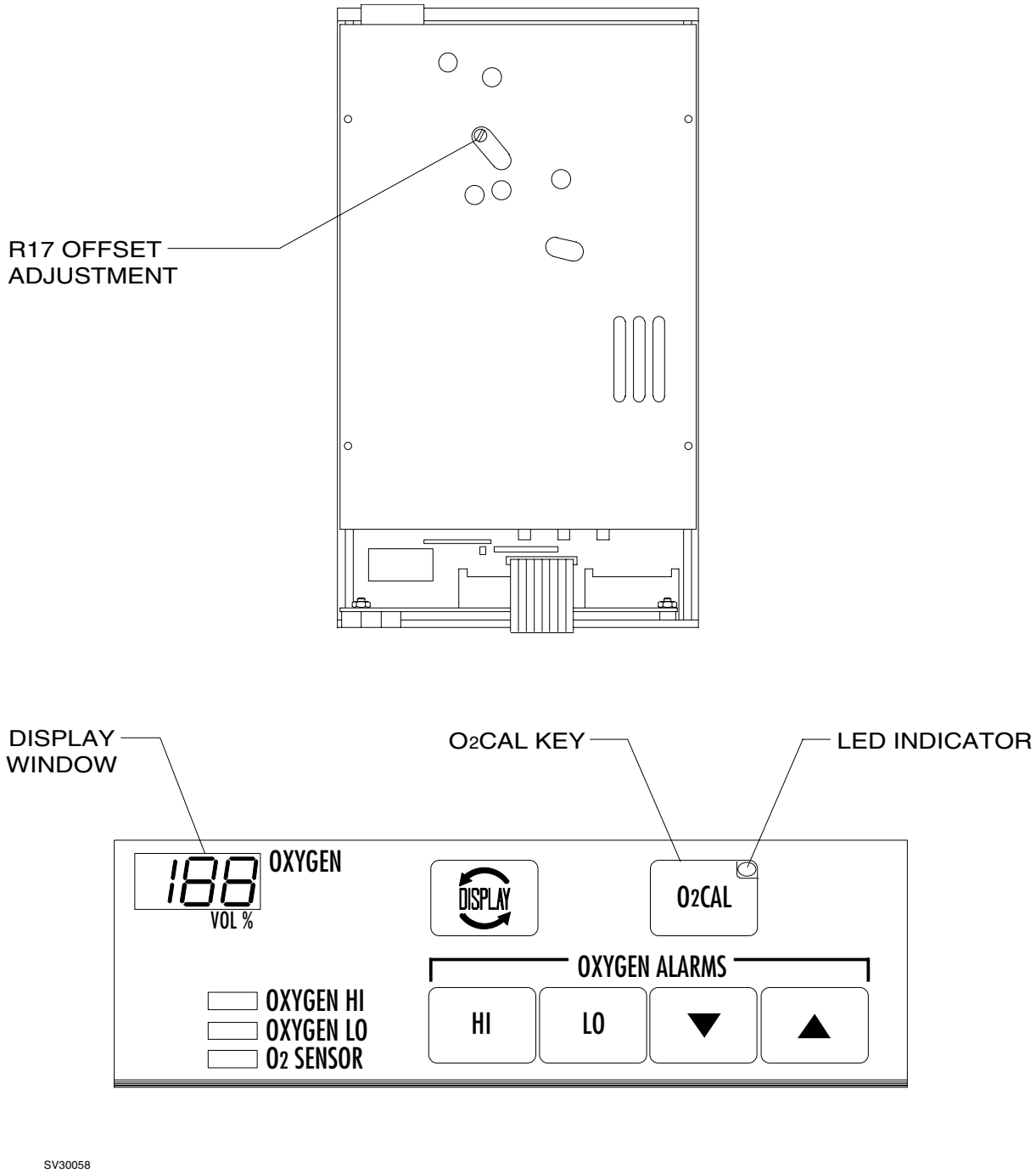


Figure 5-4: O_2MED MONITOR PANEL AND OFFSET ADJUSTMENT

5.4.2 Ambient Air Calibration

5.4.2.1 Remove the oxygen sensor assembly from the inspiratory valve dome and close off the dome with the inspiratory valve dome plug.

5.4.2.2 Set the System Power switch to ON.

5.4.2.3 Hold the sensor assembly away from any gas fittings to ensure that it is exposed only to ambient air, and allow it to stabilize for several minutes.

5.4.2.4 Press the O_2 CAL key. The yellow LED indicator in the upper right corner of the key will then illuminate to indicate that calibration has begun. The display window will show three dashes during calibration, and the messages O_2 NOT CAL and O_2 ALRM OFF will appear on the alarm CRT.

The length of time that the sensor takes to calibrate depends on the gas mixture to which the sensor had been exposed prior to calibration. If the sensor had been exposed to 21% oxygen for greater than one minute, calibration can take as little as 10 seconds. If the sensor had been exposed to higher concentrations of oxygen, calibration may last up to 50 seconds. Typically, calibration will last less than 30 seconds.

5.4.2.5 When calibration is completed, the LED indicator on the O_2 CAL key will extinguish, and the three dashes in the display window will be replaced by the currently sensed oxygen concentration.

5.4.2.6 Turn the System Power switch to STANDBY.

5.5 BAROMED Monitor Calibration

5.5.1 Turn the System Power switch to STANDBY.

5.5.2 Disconnect any external serial interface cables from the back of the monitor housing.

5.5.3 Remove the two monitor housing back cover retainer screws, and swing open the back cover.

5.5.4 Remove the top shelf from the monitor housing and disconnect its ground wire.

5.5.5 Disconnect the breathing pressure line from the absorber and connect it to a test fixture having TEE connector, digital pressure meter, and an inflation device (see Figure 5-5).

5.5.6 Press and hold the [▼] and [▲] keys on the Baromed monitor panel, and turn the System Power switch to ON.

5.5.7 With the digital pressure meter reading zero, adjust R13 on the monitor until the monitor display window reads [00.0] ± 0.5 cm H_2O.

5.5.8 Increase the pressure until the digital meter reads 60.0 cm H_2O.

5.5.9 Adjust R4 on the monitor until the monitor display window reads [60.0] ± 2.0 cm H_2O.

NOTE: Because the zero and span adjustments interact, it is necessary to repeat Steps 5.5.7 thru 5.5.9 until a valid calibration is obtained.

5.5.10 Place a small drop of red Glyptal insulating varnish on the R4 and R13 adjustment screws to lock them in place.

5.5.11 Turn the System Power Switch to STANDBY and remove AC power from the machine.

5.5.12 Reinstall the top shelf on the monitor housing and re-connect its ground wire.

5.5.13 Close the monitor housing back cover and replace the retaining screws. Re-connect any external cables that were previously removed from the serial ports.

5.5.14 Connect the breathing pressure line from the sensor interface panel to the absorber.

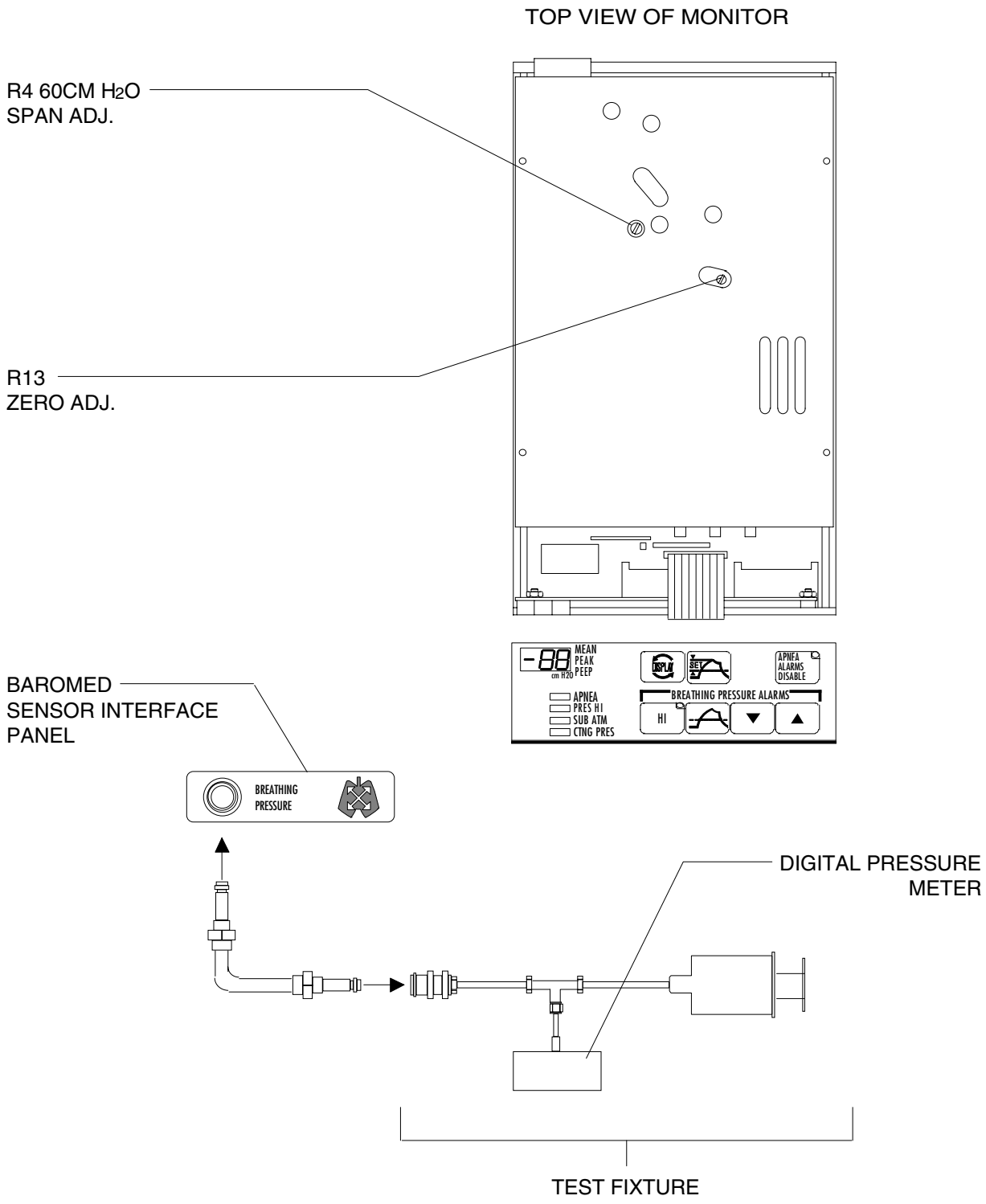


Figure 5-5: BAROMED MONITOR ADJUSTMENTS AND TEST SETUP

5.6 Multispec Analyzer Calibration and Flowrate Adjustment

NOTE: Perform the flow rate adjustment and the oxygen sensor ambient air calibration before proceeding with the multispec span calibration.

NOTE: Before attempting the multispec flowrate adjustment, first perform the flowrate test to determine whether adjustment is necessary.

5.6.1 Multispec Flowrate Test

5.6.1.1 Set the System Power switch to STANDBY.

5.6.1.2 Connect a test flowmeter to the exhaust port on the sensor interface panel.

5.6.1.3 Press and hold the ▼ and ▲ keys on the multispec monitor panel, and turn the System Power switch to ON.

The display window should indicate 02. Over a period of time the display will change to 05, and then to 30.

5.6.1.4 Wait 15 seconds, then press the HI key. The test flowmeter should indicate 200 ±25 ml/min.

5.6.1.5 Press the LO key. The test flowmeter should indicate 100 ±25 ml/min.

If both flowrates are within the allowable tolerance, an adjustment is not needed.

If either flowrate is not within specification, proceed to Step 5.6.2.

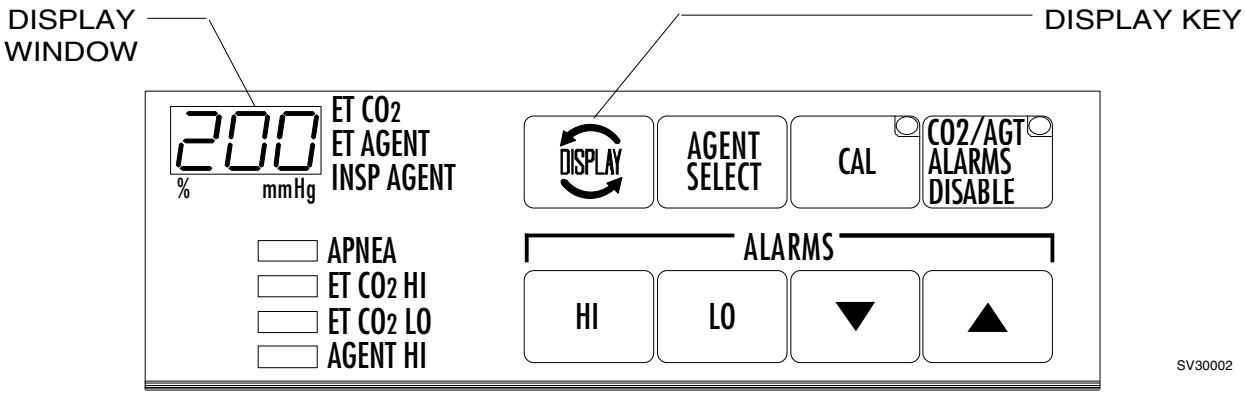


Figure 5-6: MULTISPEC MONITOR PANEL

5.6.2 Multispec Flowrate Adjustment

5.6.2.1 Press the HI key on the multispec monitor panel. The display window will show 200 .

5.6.2.2 Press the ▼ or ▲ key on the multispec monitor panel until the test flowmeter reads 200 ml/min; then press the DISPLAY key to store the calibration value. The display window will show 02 , 05 , or 30 .

5.6.2.3 Press the LO key on the multispec monitor panel. The display window will show 100 .

5.6.2.4 Press the ▼ or ▲ key on the multispec monitor panel until the test flowmeter reads 100 ml/min; then press the DISPLAY key to store the calibration value.

5.6.2.5 Set the System Power switch to STANDBY, then return it to the ON position.

5.6.2.6 Press the HI key and observe the test flowmeter, then press the LO key. Verify that both flow rates are within specification.

5.6.2.7 Disconnect the test flowmeter from the exhaust port on the sensor interface panel.

5.6.3 Oxygen Sensor Ambient Air Calibration

5.6.3.1 Remove the oxygen sensor assembly from the inspiratory valve dome and close off the dome with the inspiratory valve dome plug.

5.6.3.2 Hold the sensor assembly away from any gas fittings to ensure that it is exposed only to ambient air, and allow it to stabilize for several minutes.

5.6.3.3 Press the O_2 CAL key. The yellow LED indicator in the upper right corner of the key will then illuminate to indicate that calibration has begun. The display window will show three dashes during calibration, and the messages O_2 NOT CAL and O_2 ALRM OFF will appear on the alarm CRT.

The length of time that the sensor takes to calibrate depends on the gas mixture to which the sensor had been exposed prior to calibration. If the sensor had been exposed to 21% oxygen for greater than one minute, calibration can take as little as 10 seconds. If the sensor had been exposed to higher concentrations of oxygen, calibration may last up to 50 seconds. Typically, calibration will last less than 30 seconds.

5.6.3.4 When calibration is completed, the LED indicator on the O_2 CAL key will extinguish, and the three dashes in the display window will be replaced by the currently sensed oxygen concentration.

NOTE: Before attempting a span calibration, perform the following accuracy test to determine whether calibration is necessary.

5.6.4 Multispec Accuracy Test:

5.6.4.1 Mount the calibration gas adapter on a gas cylinder containing a certified sample of known accuracy.

NOTE: Do not use the calibration gas cylinder, NAD Part No. 4110599 or 4110599-001, to perform the accuracy test.

5.6.4.2 Set the System Power switch to ON.

5.6.4.3 Remove the oxygen sensor from the inspiratory valve to expose the sensor capsule to ambient air.

5.6.4.4 Allow the multispec analyzer to warm up to its full accuracy mode (the AGT WARMUP message will no longer appear on the alarm CRT).

5.6.4.5 Connect the output of the calibration gas adapter to the sample line at the patient interface panel as shown in Figure 5-7. Make sure that the Luer-lock connections are tight.

5.6.4.6 Set the calibration gas flow to 250 ml/min.

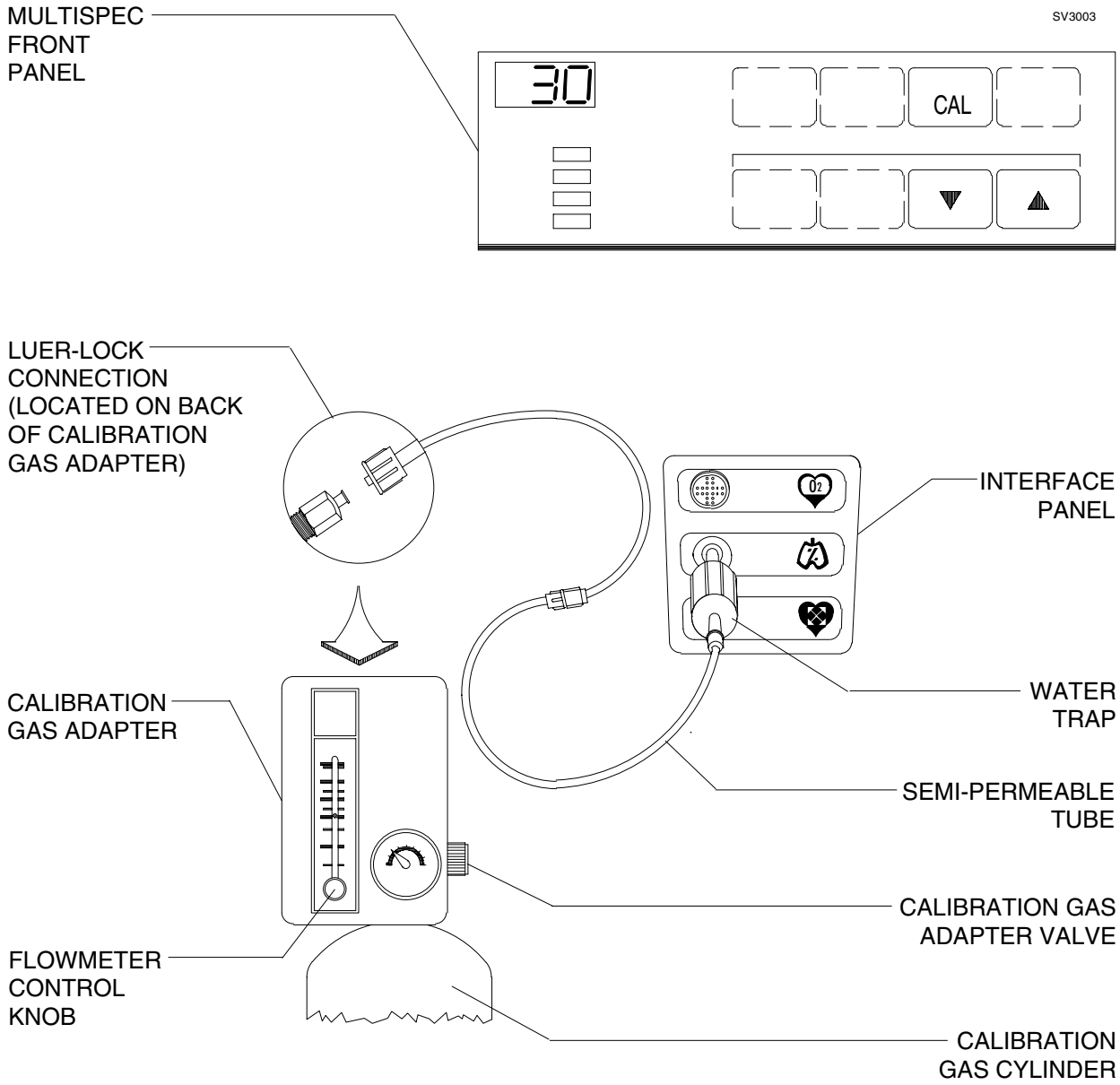


Figure 5-7: MULTISPEC SPAN CALIBRATION SETUP

5.6.4.7 Observe the current values of CO_2, N_2O, and Agent shown in the display window.

When checking the multispec accuracy against a known standard, the maximum possible error range must be considered. To calculate this range, use the summation of the multispec accuracy and noise specifications for a specific gas reading, along with the error range, along with the error percentage of the known standard.

For example, if a calibration gas that contains 2% Enflurane has a stated maximum error percentage of ±2%, one must first calculate the error percentage of Enflurane in the calibration gas, which is ±2% of 2%, or 0.04% absolute. Adding this figure to those obtained from Table 5-1, the maximum possible error range would be (±0.2) + (±0.1) + (±0.04), or ±0.34 vol %. Since the known standard contains 2% Enflurane, a multispec reading for Enflurane that is between 1.66% and 2.34% is within specifications.

Table 5-1: MULTISPEC ACCURACY AND NOISE SPECIFICATIONS

Gas Measurement	Accuracy (full accuracy mode)	Noise
Carbon Dioxide	±2.0 mm Hg (0 to 40 mm Hg) ±2.5 mm Hg (41 to 60 mm Hg) ±4.0 mm Hg (61 to 80 mm Hg)	0.5 mm Hg 2.0 mm Hg 3.0 mm Hg
Nitrous Oxide	±7.5 vol % N_2O	3 vol % N_2O
Halothane	±0.2 vol % Hal, or 10% of reading*	0.2 vol % Hal
Enflurane	±0.2 vol % Enf, or 10% of reading*	0.1 vol % Enf
Isoflurane	±0.2 vol % Iso, or 10% of reading*	0.1 vol % Iso

* Whichever is greater

5.6.4.8 Turn off the gas flow at the calibration gas adapter.

5.6.4.9 If the accuracy test produces readings that have greater than the maximum permissible error range, proceed to Step 5.6.5.4 and perform a span calibration.

5.6.4.10 If the readings are within specifications, a span calibration is not necessary. Disconnect the sample line from the calibration gas adapter and remove the adapter from the calibration gas cylinder.

5.6.5 Span calibration procedure:

5.6.5.1 Mount the calibration gas adapter on the calibration gas cylinder, (NAD Part No. 4110599 or 4110599-001).

5.6.5.2 Remove the oxygen sensor from the inspiratory valve to expose the sensor capsule to ambient air.

5.6.5.3 Connect the output of the calibration gas adapter to the sample line at the patient interface panel as shown in Figure 5-7. Make sure that the Luer-lock connections are tight.

5.6.5.4 Set the System Power switch to STANDBY.

5.6.5.5 Press and hold the [▼] and [▲] keys on the multispec monitor panel, and turn the System Power switch to ON.

The display window should indicate [02]. Over a period of time the display will change to [05], and then to [30].

5.6.5.6 Press the CAL key on the multispec monitor panel. A one second beep will occur, and a 30 second countdown will be displayed.

5.6.5.7 When the beep occurs, set the calibration gas flow to 250 ml/min.

5.6.5.8 When the span calibration is completed, three dashes [---] will appear in the display window.

NOTE: [EEE] in the display window indicates a calibration failure. If this occurs, repeat steps 5.6.5.6 and 5.6.5.7. If the multispec fails to calibrate again, contact the NAD Service Department.

5.6.5.9 Turn off the calibration gas flow. Disconnect the sample line from the calibration gas adapter and remove the adapter from the calibration gas cylinder.

5.6.5.10 Perform the PMS Procedure given in Section 6 including a vapor concentration verification.

5.6A Multispec 4610 Analyzer Calibration and Flowrate Adjustment

NOTE: Perform the flow rate adjustment and the oxygen sensor ambient air calibration before proceeding with the multispec span calibration.

Flowrate Adjustment:

5.6.1.A Connect a test flowmeter to the exhaust port on the sensor interface panel of the Narkomed 3.

5.6.2.A Verify that a water trap and sample line are connected at the patient interface panel.

5.6.3.A Turn the System Power switch to ON while simultaneously pressing the [▼] and [▲] keys on the multispec monitor. The multispec display window will show [02].

NOTE: From a cold start (AC first applied) it may require a two minute wait until the pump turns on.

During the first two minutes of operation the AGENT SELECT key will be disabled, and there will be no line block detection.

During the first eight minutes of operation the ALARMS DISABLE and CAL keys will be disabled. The fan and the Andros continue running when the machine is in standby and AC is applied.

The fan and Andros will continue running when the machine is in STANDBY, and AC is applied.

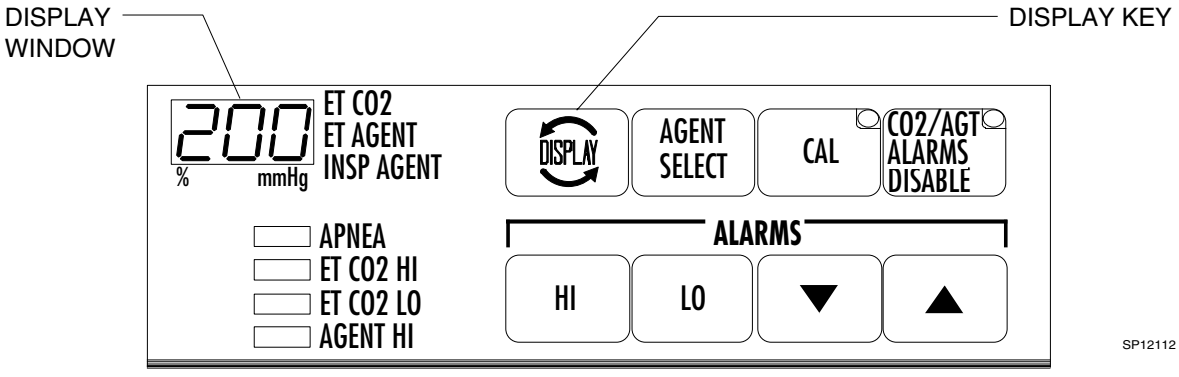


Figure 5-6A: MULTISPEC MONITOR PANEL

5.6.4.A Adjust the variable restrictor on the analyzer and pump assembly until the test flowmeter indicates 200 ml/min.

5.6.5.A Enter the line block calibration mode by pressing the HI key. The multispec monitor display window shall indicate 200.

5.6.6.A Occlude the sample line for at least 6 seconds, then press the DISPLAY key to calibrate line block. The flow at the exhaust should drop to "0".

5.6.7.A Turn the System Power switch to STANDBY, then back to ON and wait two minutes, or until there is flow at the exhaust.

5.6.8.A Verify the line block calibration by occluding the sample line. Within 10 to 15 seconds, LLL shall appear on the monitor display window. CO2 LINE BLK will be displayed in the Advisory column on the data CRT if display space is available. If display space is not available, clear the other advisories and verify that the CO2 LINE BLOCK message is displayed.

Span Calibration:

5.6.9.A Mount the calibration gas adapter (P/N 4110716) on the calibration gas cylinder (P/N 4110599).

5.6.10.A Remove the oxygen sensor from the inspiratory valve to expose the sensor capsule to ambient air.

5.6.11.A Turn the System Power switch to STANDBY.

5.6.12.A Turn the System Power switch to ON while simultaneously pressing the ▼ and ▲ keys on the multispec monitor.

The multispec monitor display window will show 02.

From a cold start, in approximately 2 minutes the 02 will change to 05. In approximately another 28 minutes the 05 will change to 30.

NOTE: From a cold start the gas analyzer requires approximately 30 minutes to reach full accuracy mode.

Approximately 22 minutes are needed if the machine has been plugged into a live AC outlet (warm start). The machine will go from the 02 mode, perform an auto Zero calibration, skip the 05 mode and go directly to the 30 mode.

When the 30 appears, the analyzer is in full accuracy mode and you may proceed with the Span calibration.

5.6.13.A Connect the output of the calibration gas adapter to the sample line as shown. Make sure that the Luer-lock connections are tight.

5.6.14.A Press the CAL key on the multispec monitor to initiate an automatic Zero calibration.

5.6.15.A Following the Zero cal, a one second beep will occur. Turn on the calibration gas flow to 200 ml/min. as soon as you hear the beep.

A 30 second countdown will be displayed.

5.6.16.A When the span calibration is completed, three dashes --- will appear in the display window.

NOTE: EEE in the display window indicates a calibration failure. If this occurs, repeat the Span calibration. If the multispec fails to calibrate again, contact the NAD Service Department.

5.6.17.A Turn off the calibration gas flow and turn the System Power switch to STANDBY.

NOTE: Upon AC power fail/interrupt, the monitor will display E07 and then will clear, and again display E07 for a few minutes until the Andros recovers. When the E07 disappears, the analyzer will proceed as from a cold start and will go through the warm-up sequence.

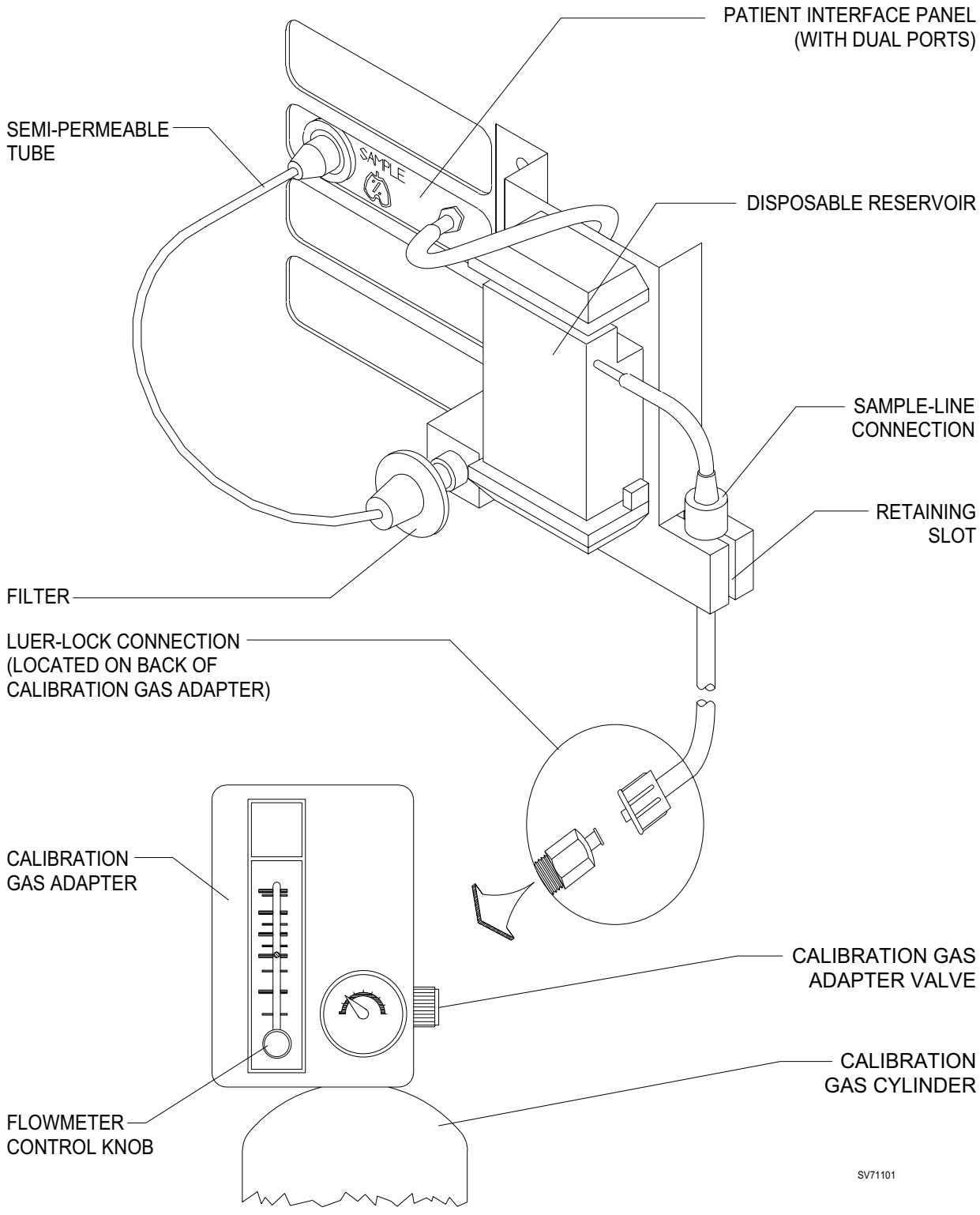


Figure 5-7A: MULTISPEC SPAN CALIBRATION SETUP

5.7 CRT Alignment

Refer to Figures 5-8 and 5-9 for locations of the CRT adjustments on the lower circuit board of the CRT assembly.

5.7.1 Set the System Power switch to STANDBY.

5.7.2 Disconnect any external serial interface cables from the back of the monitor housing.

5.7.3 Remove the two monitor housing back cover retainer screws, and swing open the back cover.

5.7.4 Remove the top shelf from the monitor housing and disconnect its ground wire.

WARNING: When making adjustments to the CRT assembly, use only non-metallic alignment tools and be careful not to touch any of the high voltage leads or CRT circuitry.

5.7.5 Turn the System Power Switch to ON, and select a display that occupies the full screen area.

5.7.6 Turn the contrast control fully clockwise.

5.7.7 Turn the master brightness control fully clockwise, then turn the master brightness control counter-clockwise to a point where the raster lines just disappear.

5.7.8 Set the contrast control for optimum screen appearance.

5.7.9 Adjust the vertical linearity control to minimize vertical distortion. (Character height should be nearly the same at top and bottom of screen.)

5.7.10 Set the vertical height control for a picture height of 3.75 inches.

5.7.11 Set the horizontal width control for a picture width of 5 inches.

5.7.12 Adjust the horizontal centering control to center the picture on the screen.

5.7.13 Adjust the focus control for the sharpest possible picture.

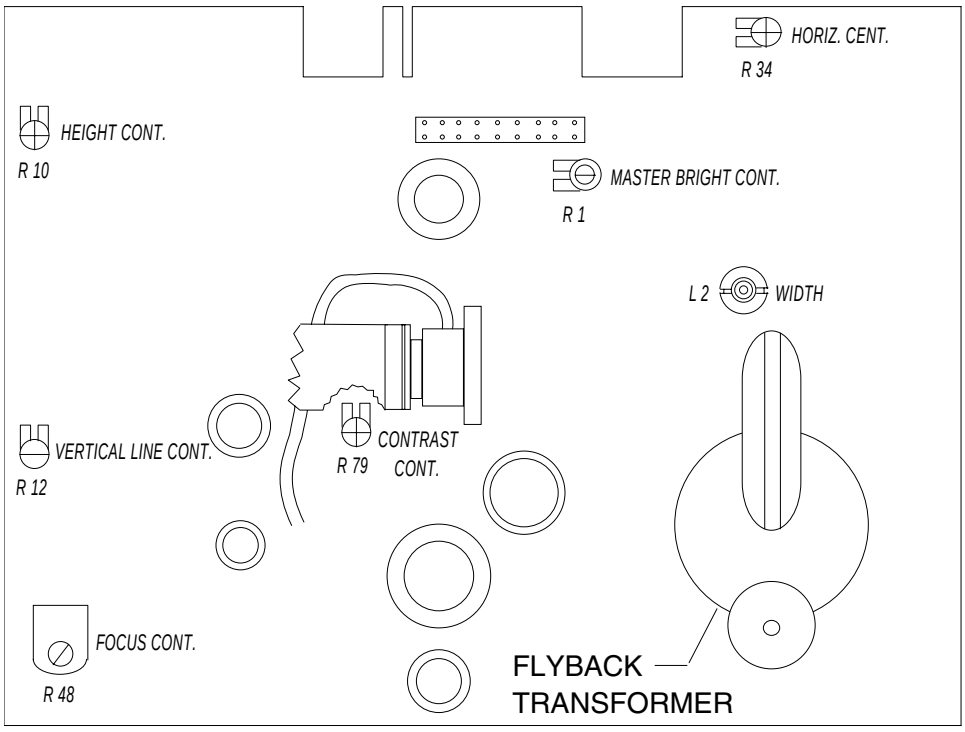


Figure 5-8: WELLS GARDNER CRT ADJUSTMENTS

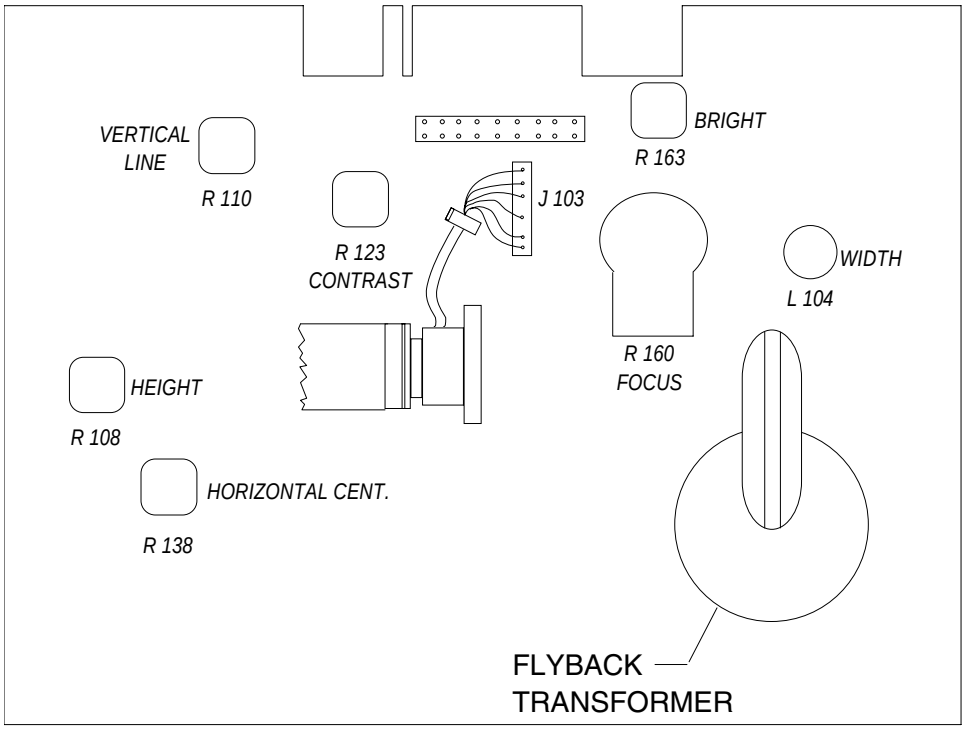


Figure 5-9: BALL CRT ADJUSTMENTS

5.7.14 Turn the System Power Switch to STANDBY and remove AC power from the machine.

5.7.15 Reinstall the top shelf on the monitor housing and re-connect its ground wire.

5.7.16 Close the monitor housing back cover and replace the retaining screws. Re-connect any external cables that were previously removed from the serial ports.

5.7.17 Perform the PMS Procedure given in Section 6.

5.8 Vaporizer Interlock Adjustment

5.8.1 Set the System Power switch to STANDBY.

5.8.2 Turn the center vaporizer handwheel ON. The left and the right vaporizer handwheels should be locked in their Zero position. If the left or right vaporizer does not lock, tighten the corresponding center set screw until the handwheel locks properly. See Figure 5-10.

5.8.3 Turn the center vaporizer OFF and turn the left vaporizer ON. The center and the right vaporizer handwheels should be locked in their Zero position. If the right vaporizer does not lock, loosen the locking nut on the right set screw and adjust the set screw until the handwheel locks properly. Tighten the locking nut while holding the set screw to maintain the correct adjustment.

NOTE: Do not over-tighten the set screws. Each vaporizer handwheel must turn easily while the other vaporizers are locked .

5.8.4 Turn the left vaporizer OFF and turn the right vaporizer ON. The center and the left vaporizer handwheels should be locked in their Zero position. If the left vaporizer does not lock, loosen the locking nut on the left set screw and adjust the set screw until the handwheel locks properly. Tighten the locking nut while holding the set screw to maintain the correct adjustment.

NOTE: When the interlock adjustment procedure is completed, ensure that all vaporizer handwheels are set to their zero or OFF position.

5.8.5 Perform the PMS Procedure given in Section 6.

VAPORIZER INTERLOCK MECHANISM REAR VIEW

SV40660

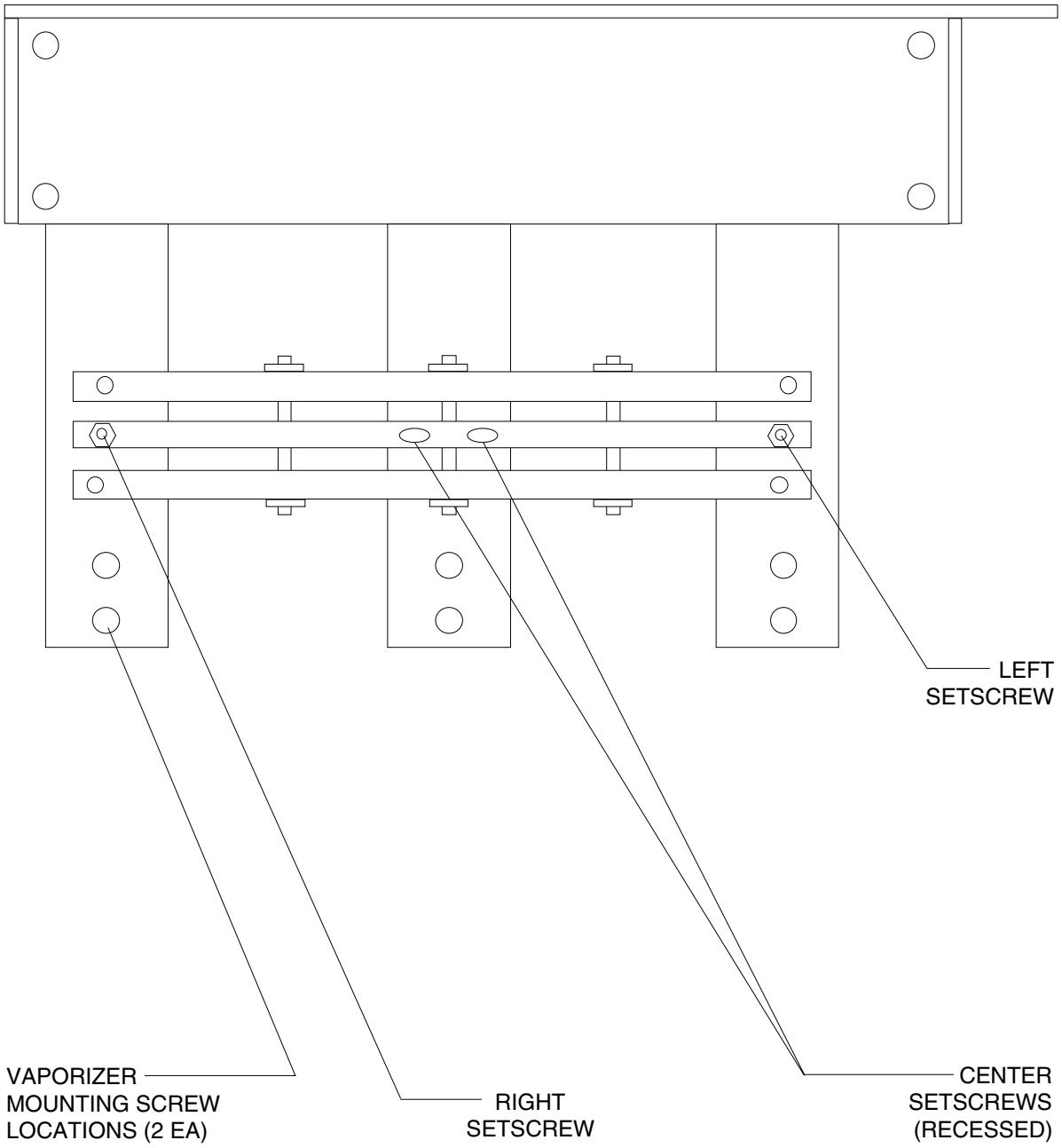


Figure 5-10: VAPORIZER INTERLOCK ADJUSTMENT

5.9 Vaporizer Select Switch Adjustment

5.9.1 Set the System Power switch to STANDBY.

5.9.2 Remove the four screws holding the rear panel of the vapor box, and remove the panel.

5.9.3 Remove the two screws holding the oxygen ratio monitor/controller to the bottom panel of the vapor box. Remove the four screws holding the bottom panel of the vapor box, and remove the panel.

5.9.4 Remove the four screws holding the front cover. Carefully lower the cover so that it is supported by the wire harnesses joined to its circuit board.

5.9.5 At the circuit board, disconnect the wire harness for the switch that is being adjusted, and connect an ohmmeter to the wire harness.

5.9.6 With the corresponding vaporizer handwheel at zero, the switch should be open. When the vaporizer is turned on, the switch contacts should close.

Loosen the adjusting screw locknut and turn the adjusting screw to raise or lower the switch bracket until the correct action is achieved. Tighten the locknut when the adjustment is completed. Refer to Figure 5-11.

NOTE: When the switch adjustment procedure is completed, ensure that the vaporizer handwheel is returned to its zero or OFF position.

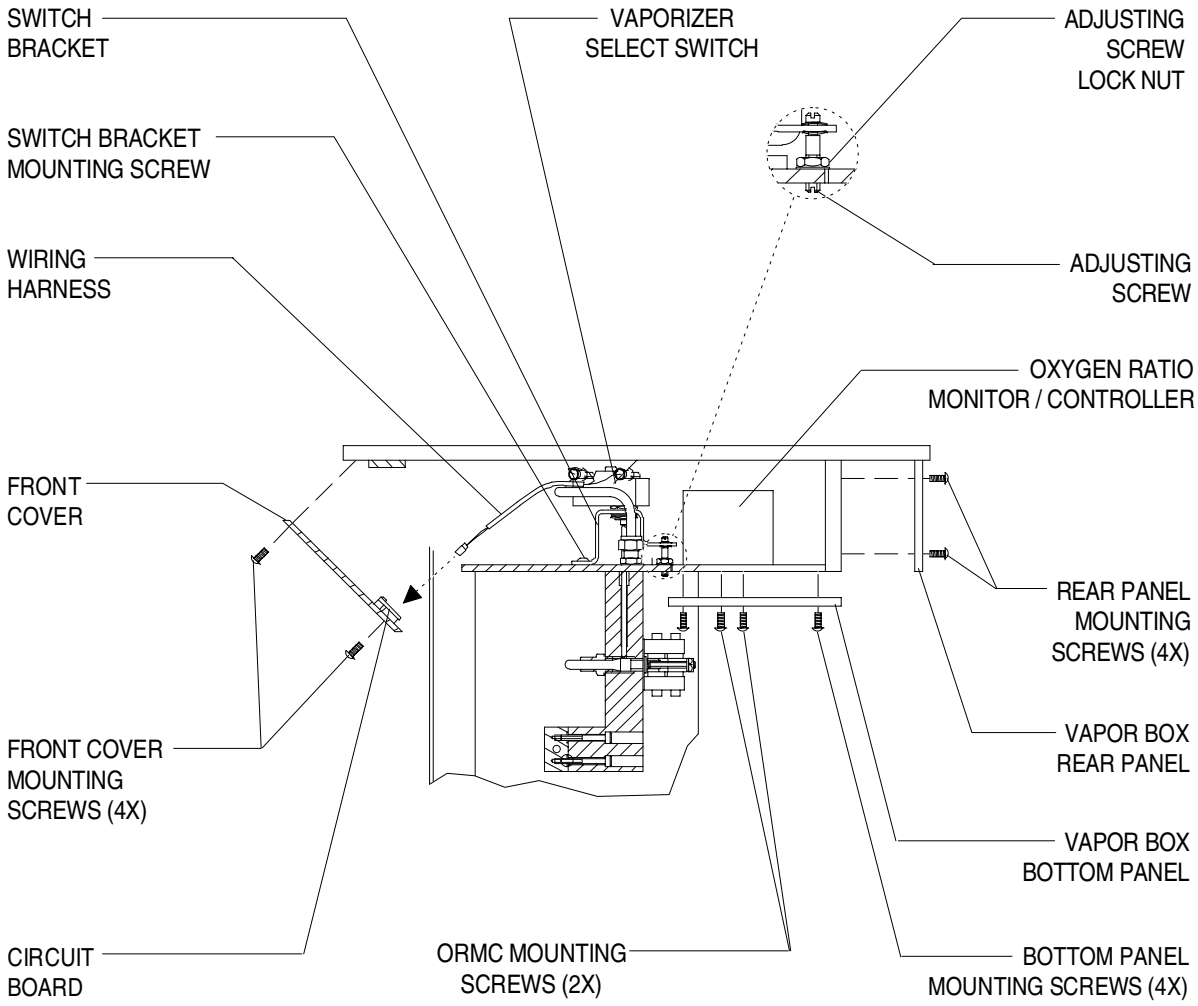
5.9.7 Disconnect the ohmmeter and connect the wiring harness to the circuit board.

5.9.8 Replace the front cover, carefully guiding the gas selector switch cam into its spring, and secure the cover with its four mounting screws.

5.9.9 Replace the bottom panel of the vapor box and secure it with the four screws. Replace the two screws that hold the oxygen ratio monitor/controller to the bottom panel.

5.9.10 Replace the rear panel of the vapor box and secure it with the four screws.

5.9.11 Perform the PMS Procedure given in Section 6.



RIGHT SIDE VIEW CUT-AWAY
SHOWING TYPICAL VAPORIZER SELECT
SWITCH MOUNTING ARRANGEMENT

Figure 5-11: VAPORIZER SELECT SWITCH ADJUSTMENT

5.10 CAPNOMED (B) Barometric Pressure Adjustment for High Altitudes

(Applies only to machines with a Capnomed monitor)

NOTE: The Capnomed monitor has the capability to compensate for the nominal atmospheric barometric pressure for a given altitude. Since the monitor does not have a pressure sensor to monitor the current atmospheric pressure (as do the NM3, VA3000 and NM4 Multispec monitors), the nominal or average pressure must be programmed into the Capnomed monitor by the following off-line calibration procedure.

5.10.1 Disconnect any external serial interface cables from the back of the monitor housing.

5.10.2 Remove the two monitor housing back cover retainer screws, and swing open the back cover.

5.10.3 Determine the firmware version in your Capnomed monitor. This procedure requires firmware version 2.01 or later, with version 2.03 (P/N 4109008) recommended.

5.10.4 Determine the average barometric pressure by calling a local weather service.

Multiply the data obtained in In.Hg by 25.4 to obtain the barometric pressure in mm Hg (needed for calibration of the Capnomed monitor).

Data can also be obtained from the chart shown on the next page. For example: At an elevation of 5209 ft., the pressure-altitude equivalent is 24.7 In.Hg.

Thus, 24.7 x 25.4 = 627 mm Hg.

ELEVATION ABOVE SL (SEA LEVEL)
(Source: 1971 Almanac, Simon & Schuster)

CITY	ALTITUDE, FT. HIGH	LOW
Akron	1081	
Atlanta	1050	940
Baltimore	490	SL
Birmingham	1260	580
Boston	330	SL
Buffalo	698	571
Chicago	672	581
Cincinnati	960	441
Cleveland	865	573
Columbus	902	702
Dallas	685	375
Dayton	981	727
Denver	5470	5130
Detroit	865	574
El Paso	4000	
Fort Worth	780	520
Honolulu	4025	SL
Houston	54	SL
Indianapolis	840	700
Kansas City	1014	722
Los Angeles	5081	SL
Louisville	761	382
Memphis	331	
Miami	Average 12 ft.	
Milwaukee	580	
Minneapolis	945	695
New Orleans	15	(-)4
New York	410	SL
Newark	273	SL
Oakland	1700	SL
Oklahoma City	1276	1070
Omaha	1270	
Philadelphia	440	SL
Phoenix	2470	1017
Pittsburgh	1240	715
Portland	1073	SL
Rochester	655	246
St. Louis	605	410
San Antonio	717	
San Diego	1586	SL
San Francisco	900	SL
Seattle	540	SL
Tampa	84	SL
Toledo	630	
Tulsa	674	

PRESSURE-ALTITUDE EQUIVALENTS
(Source: NACA Report No. 538)

IN.HG	ALT.	IN.HG	ALT.
24.0	5974	28.0	1824
24.1	5863	28.1	1727
24.2	5753	28.2	1630
24.3	5644	28.3	1533
24.4	5534	28.4	1436
24.5	5425	28.5	1340
24.6	5317	28.6	1244
24.7	5209	28.7	1148
24.8	5101	28.8	1053
24.9	4994	28.9	957
25.0	4886	29.0	863
25.1	4780	29.1	768
25.2	4673	29.2	673
25.3	4567	29.3	579
25.4	4462	29.4	485
25.5	4356	29.5	392
25.6	4251	29.6	298
25.7	4146	29.7	205
25.8	4042	29.8	112
25.9	3938	29.9	-20
26.0	3824	30.0	-73
26.1	3731	30.1	-165
26.2	3628	30.2	-257
26.3	3525	30.3	-348
26.4	3422	30.4	-440
26.5	3320	30.5	-531
26.6	3218	30.6	-622
26.7	3117	30.7	-712
26.8	3016	30.8	-803
26.9	2915	30.9	-893
27.0	2814		
27.1	2714		
27.2	2614		
27.3	2514		
27.4	2415		
27.5	2315		
27.6	2217		
27.7	2118		
27.8	2020		
27.9	1922		

5.10.5 Turn the System Power switch to STANDBY.

5.10.6 Turn the System Power switch to ON while simultaneously pressing the ▼ and ▲ keys on the Capnomed (B) monitor.

5.10.7 After approximately ten seconds, a "10" will appear in the monitor display window.

5.10.8 Press the "blank" key to the right of the DISPLAY key (see Figure 5-12).

5.10.9 A number between 600 and 800 should appear on the monitor display. Using the ▼ and ▲ keys, adjust the display to show the nominal barometric pressure reading obtained in Step 5.10.4

NOTE: The adjustment range is 600 to 800 mm Hg.

5.10.10 Press the DISPLAY key to enter the value into non-volatile memory.

5.10.11 Cycle the System Power switch to STANDBY and back to ON.

5.10.12 Verify the Capnomed Analyzer voltages: Refer to Field Service Procedure SP00051, NM3 Capnomed Analyzer Voltage Adjustment.

5.10.13 Verify the Capnomed Analyzer flow rate: Refer to Field Service Procedure SP00052, NM3 Capnomed Analyzer Flow Adjustment.

5.10.14 Close the monitor housing back cover and replace the retaining screws. Re-connect any external cables that were previously removed from the serial ports.

5.10.15 Perform the PMS Procedure given in Section 6.

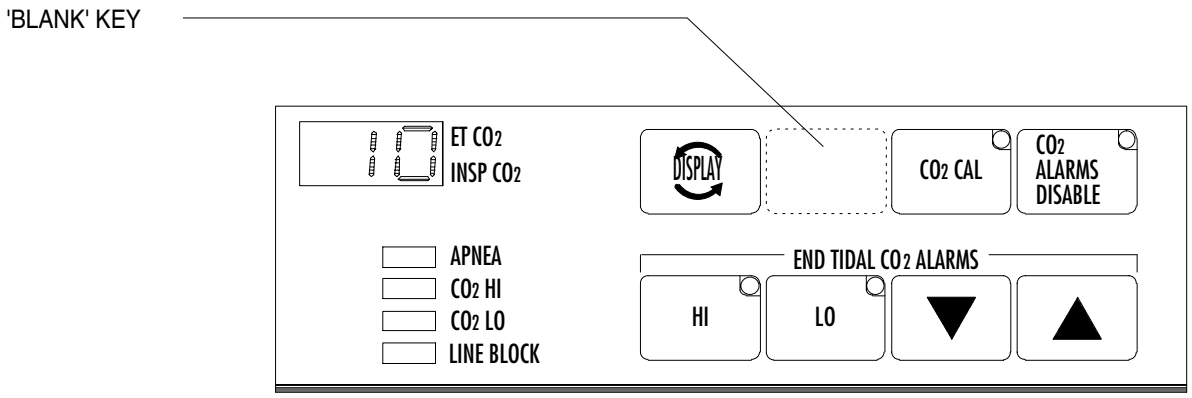


Figure 5-12: CAPNOMED MONITOR

5.11 CAPNOMED Span Calibration

NOTE: The Narkomed 3 must be plugged into an AC outlet for at least an hour prior to performing a span calibration in order to obtain full accuracy.

5.11.1 Turn the System Power switch to STANDBY.

5.11.2 Turn the System Power switch to ON while simultaneously pressing the [▼] and [▲] keys on the Capnomed monitor. This initiates a ten minute count down period to allow the Capnomed analyzer to stabilize, after which three dashes appear in the monitor display window to indicate that the analyzer is ready for calibration.

5.11.3 Press the CO_2 CAL key on the monitor. After several seconds the display window should show 00.

5.11.4 Connect the CO_2 calibration gas cylinder (P/N 4107979 or 4107979-001), calibration gas adapter (P/N 4110216), and sample line to the patient interface panel as shown in Figure 5-12.

5.11.5 Turn the knob on the calibration gas adapter counter-clockwise until the flow of gas can be heard.

5.11.6 Press the DISPLAY key on the monitor. A flashing 38 should replace the 00 in the display window.

5.11.7 After 30 seconds, the CO_2 CAL lamp should be lighted. Press the CO_2 CAL key. The 38 should stop flashing and remain lighted.

NOTE: If the display window does not stop flashing after pressing the CO_2 CAL key, notify the North American Dräger Technical Service Department.

5.11.8 Close the valve on the calibration gas adapter.

5.11.9 Turn the System Power switch to STANDBY, then return the switch to the ON position. Wait 10 minutes.

5.11.10 Turn on the CO_2 flow at the calibration gas adapter. Wait 15 seconds.

5.11.11 Disconnect the sample line from the calibration gas adapter. The End Tidal reading in the display window should be 38 ±2.

5.11.12 Close the valve on the calibration gas adapter, and turn the System Power switch to STANDBY.

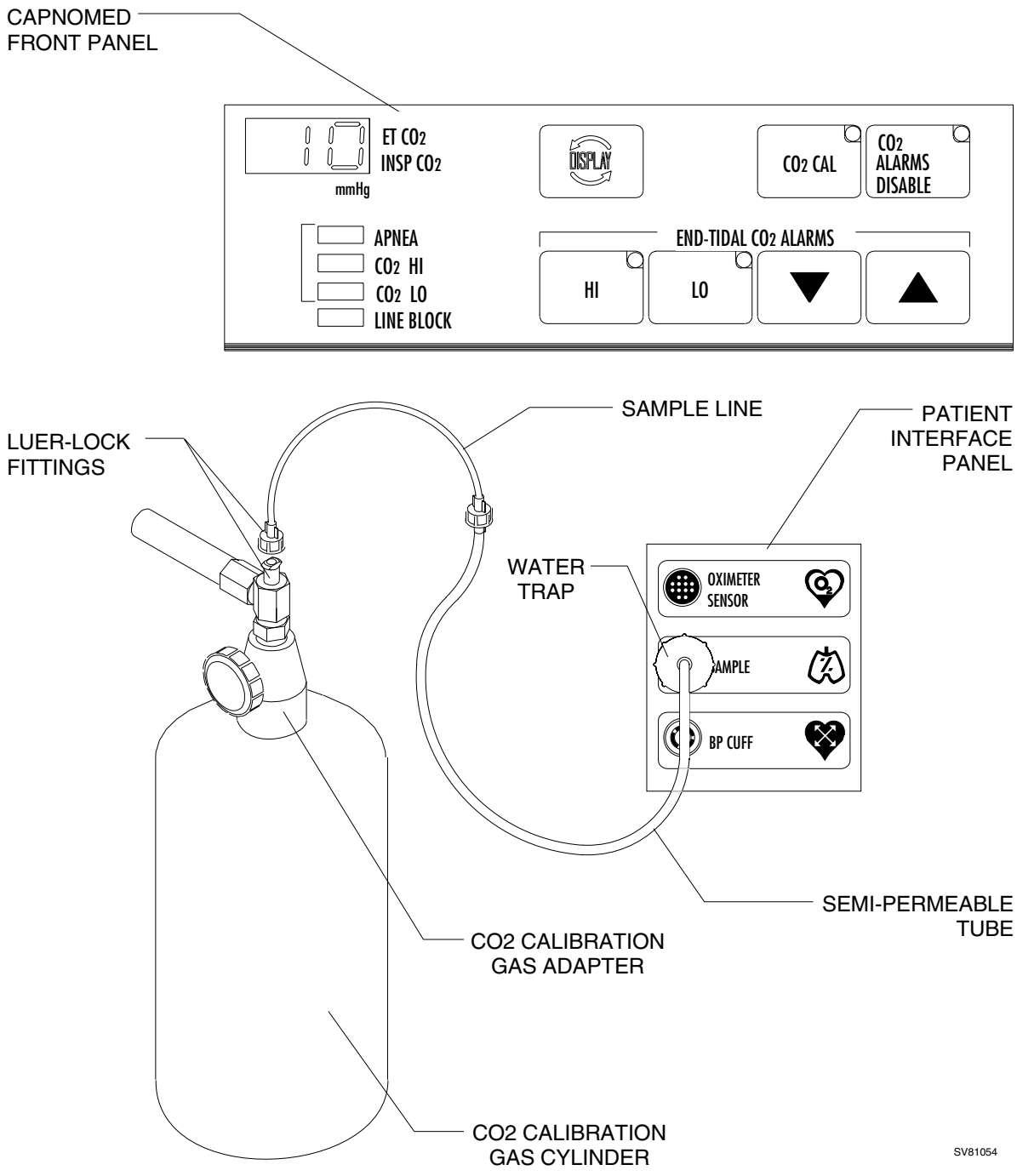


Figure 5-13CAPNOMED SPAN CALIBRATION SETUP

RETURN TO THIS MANUAL'S TABLE OF CONTENTS
RETURN TO CD-ROM TABLE OF CONTENTS

6.0 PMC PROCEDURE, NARKOMED 3

The procedures in this section shall be performed in their entirety each time a component is removed, replaced, calibrated, adjusted and during all scheduled Periodic Manufacturer's Certification (PMC) visits. A PMC checklist form, P/N S010004, available from the Draeger Medical, Inc. Technical Service Department, shall be completed by the TSR each time a PMC is performed.

NOTE: Verify the dates on test equipment calibration labels. DO NOT USE any test equipment having an expired calibration date. Notify your supervisor immediately if any equipment is found to be out of calibration.

In the space provided at the bottom of the PMS checklist form, record the Model and EL number of all calibrated test equipment used. Examples are: multimeter, digital pressure meter, Riken gas analyzer, safety analyzer, volumeter, trace gas analyzer, simulators, Eagle test equipment.

This page intentionally left blank

Periodic Manufacturer's Certification General Instructions

The purpose of this manual is to provide detailed instructions for performing a Periodic Manufacturer's Certification (PMC) inspection on all models of Narkomed anesthesia machines.

A PMC consists of a complete Periodic Manufacturer's Service procedure and a new certification level inspection based on DMI Recommendations and equipment performance. Additional inspections are also performed to insure proper product labeling.

Several additional documents have been created to ensure the success of this new program. Following is a brief description of the purpose of each document.

Field Service Procedure:
Periodic Manufacturer's Certification Forms - Part Number SP00175.
This procedure illustrates sample checklists with typical periodic maintenance items filled in, including vapor concentrations verification tests, parts replaced, general comments and certification levels. Also included are sample PMC labels marked to show several levels of certifications. An excerpt from DMI's *Anesthesia System Risk Analysis and Risk Reduction* is included, and also a sample of an Executive Summary to be furnished to the hospital's Risk Manager or Chief of Anesthesia.

Field Service Procedure:
DMI Recommendations Guidelines Index Anesthesia Systems - Part Number S010250.
This Guideline was created to provide an assessment of each machine's certification. It contains various comprehensive overviews of possible equipment conditions and their associated certification levels.

The first list in the Recommendation Guidelines is a reference chart for machine certification based on equipment status. The second is an abbreviated summary of all DMI Recommendations and Failure Codes including the Condition Number, Equipment Condition, Recommended Corrections, Certification Code, and Tests Affected when applicable.

There is also a matrix classified as "Failure Codes" which identifies the correct manner in which to document equipment tests that fail, or were unable to be performed due to circumstances beyond the control of the service technician performing the inspection. (Ex: Air cylinder supply is unavailable to perform Air High Pressure Leak test.) The Failure Codes section also indicates suggested resolution of the situation. Failure Code numbers begin at 34 and use the same certification levels strategy, and carry the same weight as DMI Recommendation equipment condition codes.

The next section of the guideline lists all DMI Recommendations identified at a machine's major assembly level. This section is divided into subsections titled: "Anesthesia System", "Vaporizers", "Absorber System", "Ventilator" and "Scavenger System". The final matrix is the most comprehensive index sorted by machine model and includes Equipment Condition, Certification Code, and DMI Recommendations. It also specifies any suggested upgrade path including ordering information that should be taken such as installing a Bellows with Pressure Limit Control 4109664-S01 Kit, after market modification kit to a machine not equipped with pressure limit control.

The letters A, B, C, D and the Roman Numerals I, II are used as codes in the individual matrix for each model of anesthesia machine. The letters A, B, C, and D are used in descending order to indicate the certification level of the equipment. They are as follows:

A = Certified
B = Certified with Recommendations
C = Conditionally Certified
D = No Certification

Roman Numerals I and II do not affect the certification level but rather are provided to give further instructions to the end user as follows:

I = The system in its present configuration shall only be used with a CO2 monitor incorporating an apnea warning. The operator of the system is advised to frequently scan the CO2 readings and alarm thresholds.

II = The present configuration of equipment requires that the unit operate at all times with an oxygen analyzer that includes a low oxygen warning. The operator of the system is advised to frequently scan the oxygen readings and alarm limits.

Following is an explanation of machine certification levels:

Certified- No recommendations apply to machine being inspected. (Only item number 33 - "No Recommendations" shall apply for this certification level.)

Certified with Recommendations- A numbered recommendation with a code of B applies to the machine being examined.

Conditionally Certified- A numbered recommendation with a code of BCI or BCII applies to the machine being examined.

No Certification- A numbered recommendation with a code of D applies to the machine being examined.

When multiple recommendations apply, "No Certification" would take precedence over "Conditionally Certified" and "Certified with Recommendations". "Conditionally Certified" would take precedence over "Certified with Recommendations".

For example:
A narkomed Compact could have recommendation numbers 8, 10, 11, and 18 apply.
8- Oxygen analyzer is not interfaced with the anesthesia machine. Code is BCII.
10- Pressure monitor is not interfaced with anesthesia ventilator. Code is B.
11- Ventilator is equipped with descending bellows. Code is BCI.
48.1- O2 analyzer is nonfunctional. Code is D.
The correct certification for this machine is D, which means "NO CERTIFICATION".

A Narkomed Standard could have recommendation numbers 2, 10, and 48.2 apply.
2- No oxygen pressure depletion warning. Code is BCII.
10- Pressure monitor is not interfaced with anesthesia ventilator. Code is B.
48.2 O2 analyzer is non functional. Code is D.
The correct certification for this machine is D, which means "NO CERTIFICATION".

Another Narkomed Standard could have recommendation numbers 2, 10, and 11 apply.
2- No oxygen pressure depletion warning. Code is BCII.
10- Pressure monitor is not interfaced with anesthesia ventilator. Code is B.
11- Ventilator is equipped with descending bellows. Code is BCI.
The correct certification for this machine is BCI and BCII, which means "CERTIFIED WITH RECOMMENDATIONS and CONDITIONALLY CERTIFIED with conditions I and II"
The reason for this is that BCI and BCII both mean that the machine is certified with recommendations (B), conditionally certified (C), with condition (I) and condition (II) equally applied.

A Narkomed 2A could have recommendation numbers 6 and 30 apply.
6- ORM instead of ORMc. Code is BCII.
30- Anesthesia machine is equipped with inhalation anesthesia vaporizers without an agent monitor in the breathing system. Code is B.
The correct certification for this machine is BCII, which means "CERTIFIED with RECOMMENDATIONS and CONDITIONALLY CERTIFIED with condition II"

A Narkomed 2B could have recommendation numbers 25 and 30 apply.
25- PEEP device on 22mm terminal of expiratory valve. Code is BCI.
30- Anesthesia machine is equipped with inhalation anesthesia vaporizers without an agent monitor in the breathing system. Code is B.
The correct certification for this machine is BCI, which means "CERTIFIED with RECOMMENDATIONS, and CONDITIONALLY CERTIFIED with condition (I) applied.

A Narkomed 4 could have recommendation number 28 apply.
28- Absorber PEEP valve does not have bypass valve. Code is B.
The correct certification for this machine is B, which means "CERTIFIED with RECOMMENDATIONS"

A Narkomed 2C (incorporating a VA3200 in the anesthesia workstation) may not have any recommendation numbers apply.
The correct certification for this machine is A, which means "CERTIFIED".

Code, D which means "NO CERTIFICATION", also means the machine shall not receive a Periodic Manufacturer's Certification label. The machine shall receive a "WARNING - This System Is Not Certified" label. This label shall be placed at a prominent location on the right side of the machine after all other previous PM and "Vigilance Audit® Validation" labels have been removed.

After a period of one year if any of the following Equipment Conditions still apply, the machine will not be certified under the Periodic Manufacturer's Certification program. The machine shall not receive a Periodic Manufacturer's Certification label. The machine shall receive a "WARNING - This is a vintage machine . . ." label. This label shall be placed at a prominent location on the right side of the machine after all other previous PM and "Vigilance Audit® Validation" labels have been removed.

PM Certification Procedure for Narkomed 3 Anesthesia System

1. Use the PM Certification form for Narkomed Anesthesia Systems (P/N S010004).

2. Completely fill in the header information.

3. Determine if the ventilator has an MJV-2 square Clippard valve. If ventilator has an MJV-2, perform the lubrication procedure in accordance with SP00062. Write in the date of lubrication next to the "MJV-2 LUBRICATION" line on the Periodic Manufacturer's Certification form. If the ventilator has a Humphrey valve, indicate so with a (H) next to the "MJV-2 LUBRICATION" line on the Periodic Manufacturer's Certification form.

4. Replace the VENTILATOR RELIEF VALVE DIAPHRAGM in accordance with SP00075. Place a check mark and the replacement date at "VENT RELIEF VALVE REPLACEMENT" line on the Periodic Manufacturer's Certification form.

5. If a TEC 6 DESFLURANE vaporizer is mounted to the machine, a label stating: "WARNING THE ADMINISTRATION OF DESFLURANE ANESTHESIA MAY REQUIRE FRESH GAS CONCENTRATIONS HIGHER THAN COMMONLY USED WITH OTHER VOLATILE ANESTHETIC AGENTS. O2 FRESH GAS CONCENTRATION OF LESS THAN 21% MAY BE OBTAINED WITH HIGH VAPORIZER SETTINGS. CONTINUOUS MONITORING OF THE O2 CONCENTRATION IN THE BREATHING SYSTEM IS THEREFORE REQUIRED. NORTH AMERICAN DRÄGER RECOMMENDS THE CONTINUOUS MONITORING OF THE CONCENTRATION OF ANESTHETIC VAPORS IN THE BREATHING SYSTEM DURING THE ADMINISTRATION OF INHALATION ANESTHESIA."(part # 4112737-001) Shall be attached to the vapor box immediately above the TEC 6 vaporizer.

6. Check all vapor 19 and 19.1 vaporizers for correct labeling. All vaporizers must have a label stating "THE CONCENTRATION OUTPUT OF THIS VAPORIZER SHALL BE VERIFIED AFTER IT HAS BEEN ATTACHED TO THE ANESTHESIA MACHINE" (part # S010015). This label shall be attached to the rear of the vaporizer directly below the mount.

7. All Key Index Safety Systems vaporizers, (K.I.S.S.) must have a label stating "CAUTION: AFTER FILLING HAS BEEN COMPLETED, REINSERT PLUG INTO UPPER FILLER PORT AND TIGHTEN LOCKING SCREW" (part # 4112520-001). This label shall be attached to the vaporizer directly above the keyed filler. Place a check mark at "K.I.S.S. LABEL" on the PM Certification form.

8. Perform Narkomed 2A/3 Caster Inspection in accordance with SP0006. Place a check mark at "2A/3 Caster Inspection". If inspection is not applicable, indicate with (N/A) on line next to "2A/3 Caster Inspection".

9. If machine is equipped with a HALOTHANE Dräger Vapor 19 or 19.1 vaporizer, determine if vaporizer must be inspected for soil condition one. Check the serial number plate located on the rear of the vaporizer for a plus (+) preceding the serial number. A HALOTHANE vaporizer serial number not preceded with a (+) must be tested for soil in accordance with SP00073. If vaporizer does not need to be inspected, indicate so with a plus (+) next to the "Vapor Inspection (H)" line on the Vigilance Audit form. If vaporizer is soil condition 0, indicate so with "SOIL 0" written next to the "Vapor Inspection (H)" line on the Vigilance Audit form. If vaporizer is soil one, indicate so with "SOIL 1" written next to the "Vapor Inspection (H)" line on the Vigilance Audit form. Place a "CAUTION DO NOT USE" label (part # 4114327) on the vaporizer, and issue a departmental alert. The TSR shall also seek permission from the equipment operator to remove the failed vaporizer from the machine and apply a replacement vaporizer or an adapter block onto the mount. All "SOIL 1" vaporizers must be removed from service for machine to receive certification.

PM Certification Procedure for Narkomed 3 Anesthesia System

10. Perform the vapor concentration test on all Dräger vapor vaporizers in accordance with SP00073 at a six month maximum interval. Perform the vaporizer concentration test on all Desflurane vaporizers in accordance with SP00091 for fixed mount vaporizers and SP00189 for user removable D-tec vaporizers at a six month maximum interval. For every vaporizer tested, fill out a "VAPOR VAPORIZER CALIBRATION CHECK" label (part # S010016). Information on this label shall include your signature, type of agent, date tested, test results @ 1%, 2.5%, 4% for H, E, I, or S vaporizers, or @ 4%, 10%, 12%, 16% for Desflurane vaporizers, and a PASS or FAIL indication. This label shall be attached to the upper right side of the vaporizer. If vaporizer fails the concentration verification, internal leak, or exclusion system tests, check "NO" in the "RECOMMENDED FOR USE" section on the PM Certification form.

    Place a "CAUTION DO NOT USE" label (part # 4114327) on the vaporizer, and issue a departmental alert. The TSR shall also seek permission from the equipment operator to remove the failed vaporizer from the machine and install a replacement vaporizer or an adapter block onto the mount. All nonfunctional Dräger vapor vaporizers must be removed from service for the machine to receive certification.

11. Proceed with PM Certification procedure. If any tests fail refer to the "Failure Codes" listing in DMI Recommendations Guidelines Index (P/N S010250) to determine correct certification level starting point. Failure codes shall be documented on the "RECOMMENDATIONS / GENERAL COMMENTS" section of the PM Certification form and on the Executive Summary. If a test fails that has not been identified by the "Failure Codes" list, consult with Draeger Medical, Inc. to assess the proper certification level.

12. Based on the "EQUIPMENT CONDITION" inspect the machine for any "DMI RECOMMENDATIONS" that would apply. Use the Narkomed 3 section of the "RECOMMENDATION GUIDELINES INDEX" (P/N S010250). Note all applicable DMI recommendations on the Executive Summary. NOTE: If using a carbon form, indicate the Equipment Condition number and to see reverse side under the "RECOMMENDATIONS / GENERAL COMMENTS" section of the form.

13. Determine the correct certification level of the machine based on the combined lowest common denominator of "Equipment Conditions" and "Failure Codes". If the machine is at least conditionally certified fill out the "PM CERTIFICATION" label. Check the box(s) on the validation label where appropriate. Write the month and year, (three months from date of PM Certification) next to "NEXT VISIT DUE:" If certification level is "D", machine shall not receive a "PM CERTIFICATION" label. Any machine not receiving a PM Certification label shall receive a "WARNING NOT CERTIFIED" label. This label shall be placed at a prominent location on the left side of the machine after all other previous PMS and Vigilance Audit Validation labels have been removed.

14. In the "CERTIFICATION LEVEL" section of the PM Certification form, record the last visit certification level, the current certification level and the next visit due month and year, (three months from date of PM Certification) in the spaces provided.

15. If applicable, remove the previous PM CERTIFICATION VALIDATION label and attach the new label (P/N S010006 w/phone #, or P/N S010007 w/o phone #) in a prominent location on the rear of the anesthesia machine.

16. Check the appropriate boxes on the "PM CERTIFICATION NOTICE" label, (part # S010011). If the machine is not certified, the last box of this notice label shall be marked. Attach this notice to the flow shield of the anesthesia machine.

17. Have the customer sign each PM Certification form or the Executive Summary, and review the equipment conditions and the recommendations with the customer.

18. Return top copy to DMI Service Department, keep middle copy for service organization records, give bottom copy to customer.

(✓) 6.1 Manual Sphygmomanometer

6.1.1 Insert the male Luer fitting of the Sphygmomanometer squeeze bulb-hose assembly into the female Luer fitting labeled BP BULB on the front of the machine.

6.1.2 Wrap the blood pressure cuff around an "E" cylinder.

6.1.3 Hand-pump the squeeze bulb until pressure of 200 mm Hg is indicated on the Sphygmomanometer gauge on the machine. Pinch the hose adjacent to the Luer fitting to assure that the hose-bulb is not the source of any leak.

6.1.4 After thirty (30) seconds, what is the pressure on the Sphygmomanometer gauge? ___ mm Hg (190-200)

6.1.5 Bleed the pressure.

6.1.6 The Sphygmomanometer should indicate within the band.

6.1.7 Attach a test Sphygmomanometer in series with the gauge being tested.

6.1.8 Hand-pump the squeeze bulb until the machine gauge indicates 100 mm Hg.

6.1.9 What does the test gauge indicate? ___ mm Hg (90-110).

6.1.10 Hand-pump the squeeze bulb until the machine gauge indicates 200 mm Hg.

6.1.11 What does the test gauge indicate? ___ mm Hg (180-220).

6.1.12 Hand-pump the squeeze bulb until the machine gauge indicates 300 mm Hg.

6.1.13 What does the test gauge indicate? ___ mm Hg (270-330).

6.1.14 Remove the test gauge.

6.1.15 Remove the blood pressure cuff from the "E" cylinder.

(✓) 6.2 Yoke Assemblies and Gauges

6.2.1 Yoke Assemblies (All Gases)

6.2.1.1 Turn the System Power switch to STANDBY.

6.2.1.2 Disconnect the pipeline supply and/or close the cylinders.

6.2.1.3 Remove cylinder or yoke plug from each yoke assembly.

6.2.1.4 Are the two (2) yoke pins installed securely in each yoke? ___ (Y)

6.2.1.5 Is there only one (1) cylinder washer on each yoke assembly? ___ (Y)

6.2.1.6 Is there a yoke plug attached to each yoke assembly? ___ (Y)

6.2.1.7 Is the proper gas identification label affixed to each yoke assembly? ___ (Y)

6.2.1.8 Attach a cylinder to each yoke assembly, open the cylinder valve, let the pressure stabilize, close the cylinder valve, and remove the cylinder from the yoke assembly.

6.2.1.9 Does the yoke check valve assembly prevent the escape of excessive pressure? ___ (Y)

6.2.1.10 Attach the cylinders to the yokes, or reinsert the yoke plugs.

6.2.2 Cylinder Gauges

6.2.2.1 Are the gauges closest to the table top for cylinder supply pressure? ___ (Y)

6.2.2.2 Bleed all pressure from the cylinder circuit.

6.2.2.3 Are the cylinder gauges at zero (0) PSI? ___ (Y)

6.2.2.4 Open the cylinder valves.

6.2.2.5 Do the cylinder pressure gauges respond properly? ___ (Y)

6.2.3 Pipeline Gauges

6.2.3.1 Are the gauges closest to the flowmeters for pipeline supply pressure? ___ (Y)

6.2.3.2 Are the pipeline pressure gauges at zero (0) PSI? ___ (Y)

6.2.3.3 Connect the pipeline supply.

6.2.3.4 Do the pipeline pressure gauges respond properly? ___ (Y)

6.2.3.5 Are the correct gas identification labels affixed at each of the pipeline inlets? ___ (Y)

6.2.3.6 Does the back panel identify each of the pipeline inlets properly? ___ (Y)

(✓) 6.3 High Pressure Leak Test

6.3.1 Oxygen High Pressure Leak Test

6.3.1.1 Disconnect the pipeline hoses.

6.3.1.2 Turn the System Power switch to STANDBY.

6.3.1.3 Open one (1) oxygen cylinder valve.

6.3.1.4 Let the pressure stabilize.

6.3.1.5 Close the oxygen cylinder valve and remove the cylinder.

6.3.1.6 Observe the oxygen cylinder pressure gauge.

6.3.1.7 After two (2) minutes, what is the pressure loss? ___ PSI (<50)

6.3.1.8 Attach the cylinder.

6.3.1.9 Repeat the procedure for the second O_2 yoke, if applicable.

6.3.2 Nitrous Oxide High Pressure Leak Test

6.3.2.1 Turn the System Power switch to ON.

6.3.2.2 Open one (1) oxygen cylinder valve and one (1) nitrous oxide cylinder valve.

6.3.2.3 Adjust the oxygen flow to 8 lpm.

6.3.2.4 Let the pressure stabilize.

6.3.2.5 Close the nitrous oxide cylinder valve and remove the cylinder.

6.3.2.6 Observe the nitrous oxide cylinder pressure gauge.

6.3.2.7 After two (2) minutes, what is the pressure loss? ___ PSI (<50)

6.3.2.8 Attach the cylinder.

6.3.2.9 Repeat the procedure for the second N_2O yoke,if applicable.

6.3.2.10 Close the oxygen flow control valve.

6.3.3 Air High Pressure Leak Test - If Applicable

6.3.3.1 Set the gas selector switch to ALL GASES.

6.3.3.2 Open the air cylinder valve.

6.3.3.3 Let the pressure stabilize.

6.3.3.4 Close the air cylinder valve and remove the cylinder.

6.3.3.5 Observe the air cylinder pressure gauge.

6.3.3.6 After two (2) minutes, what is the pressure loss? ___ PSI (<50)

6.3.3.7 Attach the air cylinder.

6.3.3.8 Set the gas selector switch to O_2+N_2O.

6.3.4 Oxygen-Helium High Pressure Leak Test - If Applicable

6.3.4.1 Set the gas selector switch to ALL GASES.

6.3.4.2 Open the oxygen-helium cylinder valve.

6.3.4.3 Let the pressure stabilize.

6.3.4.4 Close the oxygen-helium cylinder valve and remove the cylinder.

6.3.4.5 Observe the oxygen-helium cylinder pressure gauge.

6.3.4.6 After two (2) minutes, what is the pressure loss? ___ PSI (<50)

6.3.4.7 Attach the oxygen-helium cylinder.

6.3.4.8 Set the gas selector switch to O_2+N_2O.

6.3.5 Carbon Dioxide High Pressure Leak Test - If Applicable

6.3.5.1 Set the gas selector switch to ALL GASES.

6.3.5.2 Open the carbon dioxide cylinder valve.

6.3.5.3 Let the pressure stabilize.

6.3.5.4 Close the carbon dioxide cylinder valve and remove the cylinder.

6.3.5.5 Observe the carbon dioxide cylinder pressure gauge.

6.3.5.6 After two (2) minutes, what is the pressure loss? ___ PSI (<50)

6.3.5.7 Attach the carbon dioxide cylinder.

6.3.5.8 Set the gas selector switch to O_2+N_2O.

6.4 Oxygen Supply Pressure Alarm

6.4.1 Remove the table top from the machine.

6.4.2 Remove the plug from the tee fitting on the regulator output line and connect a test gauge.

6.4.3 Open and close an oxygen cylinder valve.

6.4.4 Set the oxygen flow to 2 lpm.

(✓) 6.4.5 What is the pressure on the test gauge when the O_2 SUPPLY PRESSURE alarm lamp lights? ___PSI (27-33)

6.4.6 Verify that the LO O2 SUPPLY Caution message is displayed.

6.4.7 Bleed all oxygen from the circuit, remove the test gauge and reinstall the plug in the tee fitting.

6.4.8 Close the oxygen flow control valve.

6.4.9 Reinstall the table top.

(✓) 6.5 Oxygen Supply Failure Protection

6.5.1 Nitrous Oxide O.F.P. Device

6.5.1.1 Turn the System Power switch to ON.

6.5.1.2 Disconnect the pipeline supply hoses.

6.5.1.3 Open the N_2O cylinder valve.

6.5.1.4 Open and close the oxygen cylinder valve.

6.5.1.5 Set the O_2 and N_2O flows to 4 l/min.

6.5.1.6 Does the flow of nitrous oxide cease when the oxygen pressure is depleted? ___ (Y)

6.5.1.7 Open the oxygen cylinder valve.

6.5.1.8 Close the nitrous oxide cylinder valve, and bleed the pressure from the circuit.

6.5.1.9 Open the N_2O pipeline supply valve.

6.5.1.10 Open and close the O_2 pipeline supply valve.

6.5.1.11 Does the flow of nitrous oxide cease when the oxygen pressure is depleted? ___ (Y)

6.5.1.12 Close the O_2 and nitrous oxide flow control valves.

6.5.2 Air O.F.P. Device - If Applicable

6.5.2.1 Set the gas selector switch to ALL GASES.

6.5.2.2 Open the air cylinder valve.

6.5.2.3 Open an oxygen cylinder valve.

6.5.2.4 Set the air flow to 4 lpm.

6.5.2.5 Set the oxygen flow to 4 l/min.

6.5.2.6 Close the oxygen cylinder valve.

6.5.2.7 Does the flow of air cease when the oxygen pressure is depleted? ___ (Y)

6.5.2.8 Open the oxygen cylinder valve, close the air cylinder valve, and bleed pressure from the circuit.

6.5.2.9 Close the oxygen and air flow control valves.

6.5.2.10 Set the gas selector switch to O_2+N_2O.

6.5.3 Oxygen-Helium O.F.P. Device - If Applicable

6.5.3.1 Set the gas selector switch to ALL GASES.

6.5.3.2 Open the oxygen-helium cylinder valve.

6.5.3.3 Open one (1) oxygen cylinder valve.

6.5.3.4 Set the oxygen-helium flow to 4 lpm; set the oxygen flow to 4 lpm.

6.5.3.5 Close the oxygen cylinder valve.

6.5.3.6 Does the flow of oxygen-helium cease when the oxygen pressure is depleted? ___ (Y)

6.5.3.7 Close the oxygen-helium flow control valve.

6.5.3.8 Close the oxygen flow control valve.

6.5.3.9 Close the oxygen flow control valve.

6.5.3.10 Set the gas selector switch to O_2+N_2O.

6.5.4 Carbon Dioxide O.F.P. Device - If Applicable

6.5.4.1 Set the gas selector switch to ALL GASES.

6.5.4.2 Open the cylinder of carbon dioxide.

6.5.4.3 Open one (1) oxygen cylinder valve.

6.5.4.4 Set the carbon dioxide flow to 500 ml/min.

6.5.4.5 Set the oxygen flow to 4 l/min.

6.5.4.6 Close the oxygen cylinder valve.

6.5.4.7 Does the flow of carbon dioxide cease when the oxygen pressure is depleted? ___ (Y)

6.5.4.8 Close the carbon dioxide and oxygen flow control valves.

6.5.4.9 Set the gas selector switch to O_2+N_2O.

(✓) 6.6 O2MED Offset Calibration

6.6.1 Turn the System Power switch to STANDBY.

6.6.2 Press and hold the ▼ and ▲ keys on the oxygen monitor panel, and turn the System Power switch to ON.

6.6.3 Verify a monitor display of 100 ±1.

6.6.4 Turn the System Power switch to STANDBY.

(✓) 6.7 O2MED Calibration, Accuracy and Alarms Test

6.7.1 Turn the System Power switch to ON.

6.7.2 Remove the oxygen sensor from the inspiratory valve dome and disconnect the oxygen sensor cable at the interface panel.

6.7.3 The alarm CRT shall display the following messages: "O_2 SENS DISC", "O_2 NOT CAL", "O_2 ALRM OFF".

6.7.4 Reconnect the O_2 Med sensor cable.

6.7.5 Press the O_2CAL key on the monitor.

6.7.6 After calibration is completed, what is the oxygen concentration? ___ % (21)

6.7.7 The alarm CRT shall display "% OXYGEN LOW" under the warning heading and the heading shall be flashing. There should be a continuous audible alarm.

6.7.8 Press the LO oxygen alarm key.

6.7.9 Using the ▲ and ▼ keys, verify that the low alarm limit has a range from 21 to 99%.

6.7.10 Set the low limit to 21.

6.7.11 Press the HI oxygen alarm key.

6.7.12 Using the ▲ and ▼ keys, verify that the high alarm limit has a range from 100 to 22%.

6.7.13 Set the high alarm to 22.

6.7.14 Expose the O_2 Med sensor to 50% oxygen.

6.7.15 The alarm CRT shall display "% OXYGEN HI" in the Advisory column.

6.7.16 Adjust the high alarm to 51%.

6.7.17 The "% OXYGEN HI" message will now be extinguished.

6.7.18 Return the high alarm to 100.

6.7.19 Place the sensor into the valve dome, set the oxygen flow to 5 lpm, set the Man/Auto to BAG, close the APL valve, attach a 12-inch hose to the inspiratory valve and occlude the bag mount.

6.7.20 After 3 minutes, what is the oxygen concentration? ___ % (97-100)

6.7.21 Close the oxygen flow control valve.

(✓) 6.8 Oxygen Concentration Test

6.8.1 Oxygen + Nitrous Oxide Concentration Test

6.8.1.1 Connect a 12-inch hose to the inspiratory valve.

6.8.1.2 Set the Manual/Automatic to BAG.

6.8.1.3 Close the APL valve.

6.8.1.4 Occlude the bag mount.

6.8.1.5 Insert the sensor from a calibrated O_2Med into the valve dome adapter on the inspiratory valve.

6.8.1.6 Depress the O_2FLUSH button for 15 seconds.

6.8.1.7 Set the oxygen flow to 4 lpm.

6.8.1.8 Does the O_2Med read 97-100% within 3 minutes? ___ (Y)

6.8.1.9 Set the nitrous oxide flow to 2 lpm.

6.8.1.10 What is the oxygen concentration? ___ % (64-70)

6.8.1.11 Close the oxygen and nitrous oxide flow control valves.

6.8.2 Oxygen + Air Concentration Test - If Applicable

6.8.2.1 Set the gas selector switch to ALL GASES.

6.8.2.2 Depress the O_2FLUSH button for 15 seconds.

6.8.2.3 Does the O_2Med read 97-100% within 3 minutes? ___ (Y)

6.8.2.4 Set the oxygen flow to 4lpm.

6.8.2.5 Set the air flow to 2 lpm.

6.8.2.6 What is the oxygen concentration? ___ % (71-77)

6.8.2.7 Close the oxygen and air flow control valves.

6.8.2.8 Set the gas selector switch to O_2+N_2O.

6.8.3 Oxygen + Oxygen-Helium Concentration Test - If Applicable

6.8.3.1 Set the gas selector switch to ALL GASES.

6.8.3.2 Depress the O_2FLUSH button for 15 seconds.

6.8.3.3 Does the O_2Med read 97-100% within 3 minutes? ___ (Y)

6.8.3.4 Set the oxygen + helium flow to 2 lpm.

6.8.3.5 Set the oxygen flow to 4 lpm.

6.8.3.6 What is the oxygen concentration? ___ % (72-78)

6.8.3.7 Close the oxygen + helium flow control valve.

6.8.3.8 Close the oxygen flow control valve.

6.8.3.9 Set the gas selector switch to O_2+N_2O.

6.8.4 Oxygen + Carbon Dioxide Concentration Test - If Applicable

6.8.4.1 Set the gas selector switch to ALL GASES.

6.8.4.2 Depress the O_2FLUSH button for 15 seconds.

6.8.4.3 Does the O_2MED read 97-100% within 3 minutes?
___ (Y)

6.8.4.4 Set the oxygen flow to 1000 ml/min.

6.8.4.5 Set the carbon dioxide flow to 500 ml/min.

6.8.4.6 What is the oxygen concentration? ___ % (64-70)

6.8.4.7 Close the carbon dioxide flow control valve.

6.8.4.8 Close the oxygen flow control valve.

6.8.4.9 Set the gas selector switch to O_2+N_2O.

6.8.5 Oxygen + Nitrogen Concentration Test - If Applicable

6.8.5.1 Depress the O_2FLUSH button for 15 seconds.

6.8.5.2 Does the O_2MED read 97-100% within 3 minutes?___ (Y)

6.8.5.3 Set the gas selector switch to ALL GASES.

6.8.5.4 Set O_2 flow to 4 l/min; nitrogen flow to 2 l/min.

6.8.5.5 What is the oxygen concentration after 3 minutes? ___ % (64-70)

6.8.5.6 Close the nitrogen flow control valve.

6.8.5.7 Set the gas selector switch to O_2+N_2O.

6.8.5.8 Close the oxygen flow control valve.

6.8.6 Oxygen + Helium Concentration Test - If Applicable

6.8.6.1 Depress the O_2 FLUSH button for 15 seconds.

6.8.6.2 Does the O_2 MED read 97-100% within 3 minutes? ___ (Y)

6.8.6.3 Set the gas selector switch to ALL GASES.

6.8.6.4 Set O_2 flow to 4 l/min; helium flow to 2 l/min.

6.8.6.5 What is the oxygen concentration after 3 minutes? ___% (64-70)

6.8.6.6 Close the helium flow control valve.

6.8.6.7 Set the gas selector switch to O_2 + N_2O.

6.8.6.8 Close the oxygen flow control valve.

This page intentionally left blank

(✓) 6.9 Flowmeter Test

6.9.1 Oxygen Flowmeter Test

6.9.1.1 Is it possible to adjust the flow of oxygen over the full range of the flowmeters? ___ (Y)

6.9.1.2 Close the O_2 cylinder valve, bleed the pressure, and reconnect the pipeline hoses.

6.9.1.3 Is it possible to adjust the flow of oxygen over the full range of the flowmeters? ___ (Y)

6.9.1.4 Is the correct flow control knob and label attached to the oxygen flow control valve? ___ (Y)

6.9.1.5 Close the oxygen flow control valve.

6.9.1.6 What is the minimum flow of oxygen? ___ ml (125-175 ml/min; 0 ml for 4107615A (Minimum O_2 Flow Elimination))

6.9.2 Nitrous Oxide Flowmeter Test

6.9.2.1 Set the oxygen flow to 4 lpm.

6.9.2.2 Open the nitrous oxide cylinder valve.

6.9.2.3 Is it possible to adjust the flow of nitrous oxide over the full range of the flowmeter? ___ (Y)

6.9.2.4 Close the nitrous oxide cylinder valve, bleed the pressure, and reconnect the pipeline hose.

6.9.2.5 Is it possible to adjust the flow of nitrous oxide over the full range of the flowmeters? ___ (Y)

6.9.2.6 Is the correct flow control knob and label attached to the N_2O flow control valve? ___ (Y)

6.9.2.7 Close the oxygen and nitrous oxide flow control valves.

(✓) 6.9.3 Air Flowmeter Test - If Applicable

6.9.3.1 Set the gas selector switch to ALL GASES.

6.9.3.2 Open the air cylinder valve.

6.9.3.3 Is it possible to adjust the flow of the air over the full range of the flowmeter? ___ (Y)

6.9.3.4 Close the air cylinder valve; bleed the pressure and reconnect the pipeline hose.

6.9.3.5 Is it possible to adjust the flow of air over the full range of the flowmeter?

6.9.3.6 Close the air flow control valve.

6.9.3.7 Is the correct flow control knob and label attached to the air flow control valve? ___ (Y)

6.9.3.8 What is the minimum flow of oxygen? ___ ml (0)

6.9.3.9 Set the gas selector switch to O_2+N_2O.

6.9.4 Oxygen-Helium Flowmeter Test - If Applicable

6.9.4.1 Set the gas selector switch to ALL GASES.

6.9.4.2 Open the oxygen-helium gas cylinder valve.

6.9.4.3 Is it possible to adjust the flow of the oxygen-helium over the full range of the flowmeter? ___ (Y)

6.9.4.4 Close the oxygen-helium flow control valve.

6.9.4.5 Is the correct flow control knob and label attached to the oxygen-helium flow control valve? ___ (Y)

6.9.4.6 Set the gas selector switch to O_2+N_2O.

6.9.5 Carbon Dioxide Flowmeter Test - If Applicable

6.9.5.1 Set the gas selector switch to ALL GASES.

6.9.5.2 Open the carbon dioxide gas cylinder valve.

6.9.5.3 Is it possible to adjust the flow of the carbon dioxide over the full range of the flowmeter? ___ (Y)

6.9.5.4 Close the carbon dioxide flow control valve.

6.9.5.5 Is the correct flow control knob and label attached to the carbon dioxide flow control valve? ___ (Y)

6.9.5.6 Set the gas selector switch to O_2+N_2O.

6.9.6 Auxiliary Oxygen Flowmeter Test - If Applicable

6.9.6.1 Connect a test cm H_2O gauge to the outlet.

6.9.6.2 Bleed any pressure.

6.9.6.3 Is there an increase in pressure? ___ (N)

6.9.6.4 Increase the pressure to 50 cm H_2O.

6.9.6.5 After thirty (30) seconds, what is the pressure? ___ cm H_2O (30-50)

6.9.6.6 Remove the test gauge.

6.9.6.7 Is it possible to adjust the flow over the full range of the flowmeter? ___ (Y)

6.9.6.8 Adjust the flow to 5 lpm.

6.9.6.9 Hold the sensor from a calibrated O_2Med at the flowmeter outlet.

6.9.6.10 What is the oxygen concentration? ___ % (97-100)

6.9.6.11 Remove the O_2Med sensor.

6.9.6.12 Close the flowmeter flow control valve.

6.10 Freshgas Leak Test

6.10.1 Turn the System Power switch to STANDBY.

6.10.2 Remove the 15 mm connector from the FRESHGAS OUTLET.

6.10.3 Is the common gas outlet assembly in good condition? ___ (Y)

6.10.4 Connect a digital pressure manometer and Fresh Gas Leak Test Device to the freshgas outlet.

6.10.5 Apply 50 cm H_2O of pressure to the system.

(✓) 6.10.6 After thirty (30) seconds, what is the pressure on the manometer? ___ (>40 cm H_2O)

6.10.7 Turn on the left mounted vaporizer to the first graduated marking.

6.10.8 Apply 50 cm H_2O of pressure to the system.

(✓) 6.10.9 After thirty (30) seconds, what is the pressure on the manometer? ___ (>40 cm H_2O)

6.10.10 Turn off the vaporizer.

6.10.11 Remove the test equipment from the Fresh Gas Outlet.

6.10.12 Turn the System Power switch to ON.

6.10.13 Open the O_2 flow control valve to 5 l/min., purge the system for 5 seconds, then close the O_2 flow control valve.

6.10.14 Turn the System Power switch to STANDBY.

(✓) 6.10.15 Turn on the center mounted vaporizer to the first graduated marking, repeat Steps 6.10.8 thru 6.10.14. ___ (>40 cm H_2O)

6.10.16 Turn on the right mounted vaporizer to the first graduated marking, repeat Steps 6.12.8 thru 6.12.14. ___ (>40 cm H_2O)

6.10.17 Remove the manometer and Fresh Gas Leak Test Device.

6.10.18 Reconnect the 15 mm connector from the absorber system to the FRESHGAS OUTLET.

6.10.19 Is the FRESHGAS OUTLET label on the freshgas outlet? ___ (Y)

(✓) 6.11 Repack MAN/AUTO Selector Valve

6.11.1 Remove the four screws securing the stick shift block to the selector valve body and remove the block.

6.11.2 Remove the spring and valve channel from the valve body.

6.11.3 Remove all residual lubricant from the valve channel.

6.11.4 Remove all residual lubricant from the valve body.

6.11.5 Apply a minimal amount of "stop cock" lubricant to the tapered surface of the valve channel, and ensure complete coverage of lubricant.

6.11.6 Insert the valve channel into the valve body.

6.11.7 Insert the spring into the stick shift block.

6.11.8 Align the index pins on the stick shift block to the holes in the valve channel.

6.11.9 Secure the stick shift block to the selector valve body with the four screws that were previously removed.

(✓) 6.12 Absorber System Inspection

6.12.1 Remove the inspiratory and the expiratory valve domes.

6.12.2 Is there a broken or bent pin on the valve assembly?
Inspiratory ___ (N) Expiratory ___ (N)

6.12.3 Is there a broken pin on the valve domes?
Inspiratory ___ (N) Expiratory ___ (N)

6.12.4 Is the valve disc in good condition?
Inspiratory ___ (Y) Expiratory ___ (Y)

6.12.5 Are the valve dome washers in good condition? ___ (Y)

6.12.6 Reinstall the inspiratory and expiratory valve domes.

6.12.7 Are there two (2) spring clips on the absorber rods? ___(Y)

6.12.8 Is the cm H_2O gauge at zero (0)? ___(Y)

6.12.9 Remove the O_2Med sensor plug from the inspiratory valve dome adapter and examine the two O-rings at the bottom of the plug.

6.12.10 Uncap the O_2Med sensor and examine the two O-rings at the bottom of the sensor.

6.12.11 Reinstall the O_2Med sensor into the inspiratory valve dome adapter.

(✓) 6.13 Lubrication, Spiromed Sensor

6.13.1 Remove the expiratory valve.

6.13.2 Remove the Spiromed Sensor.

6.13.3 Locate the four lateral holes at the sides of the Spiromed sensor marked by printed arrows.

CAUTION: Use only Sensor Lubrication Kit P/N 221818 P for the following procedure.

6.13.4 Remove the protective cover from the pipette and open the lubricant bottle.

6.13.5 Dip the tip of the pipette into the lubricant and draw one drop of lubricant into the pipette by pulling the pin upwards.

6.13.6 Insert the pipette into one of the four holes as far as it will go. Push the pin forward to its stop to inject lubricant into the hole.

6.13.7 Repeat the procedure on the three remaining holes.

6.13.8 Wipe any lubricant residue from the exterior of the sensor.

6.13.9 Reattach the sensor to the absorber top dome.

6.13.10 Reattach the expiratory valve to the sensor.

(✓) 6.14 Breathing System Leak test

6.14.1 Interconnect the inspiratory and expiratory valves with a 12 in. hose with 22 mm ends (P/N 9995112).

6.14.2 Attach a test terminal (P/N 4104389) with a cuff inflation bulb and hose assembly (P/N 4109398) to the bag mount.

6.14.3 Set the Man/Auto selector valve to BAG, and close the APL valve (fully clockwise).

6.14.4 Apply 50 cm H_2O pressure to the absorber system.

6.14.5 After 30 seconds, what is the pressure in the absorber system? ___ cm H_2O ($\geq$30)

(✓) 6.15 Absorber Flow Direction and Leak Test

6.15.1 Expiration Valve Leak Test

6.15.1.1 Close the APL valve.

6.15.1.2 Connect a 22mm hose between the inspiration valve and the bag mount.

6.15.1.3 Connect a test terminal to the expiration valve.

6.15.1.4 Connect a Capnomed flowmeter to the test terminal.

6.15.1.5 Turn the System Power switch to ON, turn up the oxgen flow until the system pressurizes to 30 cmH_2O.

6.15.1.6 Verify that the value indicated on the flowmeter is ≤60ml/min.

6.15.1.7 Remove all test equipment.

6.15.2 Inspiratory valve leak test

6.15.2.1 Connect a test terminal to the inspiratory valve.

6.15.2.2 Connect a tee adapter and calibrated pressure meter to the test terminal.

6.15.2.3 Connect a pressure bulb to the open port of the tee adapter.

6.15.2.4 Connect another test terminal to the bag connector.

6.15.2.5 Connect a Capnomed flowmeter to the test terminal on the bag mount.

6.15.2.6 Pressurize the system to 30 cmH_2O.

6.15.2.7 Verify that the flow meter indicates ≤60 ml/min.

6.15.2.8 Remove all test equipment.

6.15.2.9 Open the APL valve.

6.15.3 Flow Direction Test

6.15.3.1 Attach a breathing circuit with a 3-liter bag at the Y-piece to the inspiration and expiration valves.

6.15.3.2 Attach a 3-liter bag to the swivel bag mount.

6.15.3.3 Set the O_2 flow to 4 l/min.

6.15.3.4 Inflate the simulated lung by briefly using the O_2 Flush.

6.15.3.5 Partially close the APL valve.

6.15.3.6 Squeeze the breathing bag attached to the bag mount at a rate of approximately 10 BPM. Readjust the APL valve if required to properly ventilate the simulated lung.

6.15.3.7 Observe the operation of each unidirectional valve disc at eye level and make sure the inspiratory valve disc raises only during the inspiration phase, and the expiratory valve raises only during the exhalation phase. Watch the valves until satisfied that both valves operate correctly, and move freely without sticking.

6.15.3.8 Open the APL valve.

(✓) 6.16 APL Valve Test

6.16.1 Open the APL valve to its stop.

6.16.2 Turn the SYSTEM POWER switch to ON.

6.16.3 Set the oxygen flow to 8 lpm.

6.16.4 What is the pressure on the absorber pressure gauge? ___ cm H_2O ($\leq$3)

(✓) 6.17 PEEP Bypass Valve - If applicable.

6.17.1 Set the O_2 flow to 5 l/min.

6.17.2 Adjust the PEEP valve clockwise to the maximum position.

6.17.3 Raise the bypass valve to the "PEEP ON" position.

6.17.4 What is the maximum PEEP? ___ cm H_2O (15-22 cm H_2O).

6.17.5 Does the PEEP valve adjust smoothly? ___ (Y)

6.17.6 Adjust the PEEP valve counter-clockwise to its minimum position.

6.17.7 What is the minimum PEEP? ___ cm H_2O (2-3 cm H_2O).

6.17.8 Adjust the PEEP valve clockwise to its maximum position.

6.17.9 Lower the bypass valve to the "PEEP OFF" position.

6.17.10 What is the maximum PEEP? ___ cm H_2O (2-3 cm H_2O)

6.17.11 Adjust the PEEP valve counter-clockwise to its minimum position.

6.17.12 Close the O_2 flow control valve.

6.18 Ventilator Test

6.18.1

6.18.1.1 Set the Manual/Automatic selector to AUTO.

6.18.1.2 Set the FREQUENCY to 10.

6.18.1.3 Set the I:E RATIO to 1:2.

6.18.1.4 Set the Tidal Volume to 1000 ml.

6.18.1.5 Attach a patient circuit to the absorber system.

6.18.1.6 Adjust the O_2 flow to 3 lpm.

6.18.1.7 Allow the bellows to inflate.

6.18.1.8 Is the "APNEA-P OFF" message displayed in the ADVISORY column? ___ (Y) (if no, press the "APNEA ALARM DISABLE" key)

6.18.1.9 Is "VOL-ALARM OFF" message displayed in the ADVISORY column? ___ (Y) (if no, press the "VOLUME ALARM DISABLE" key)

6.18.1.10 Turn the ventilator on.

6.18.1.11 Do the "APNEA-P OFF" and "VOL-ALARM OFF" messages disappear from the ADVISORY column? ___ (Y)

6.18.1.12 Adjust the INSPIRATORY FLOW to the maximum of the LOW zone.

6.18.1.13 Occlude the Y-piece with your thumb.

(✓) 6.18.1.14 What is the peak inspiratory pressure? ___ cm H_2O (>30)

(✓) 6.18.2 Inspiratory : Expiratory Ratio

6.18.2.1 Attach a test lung to the Y-piece.

6.18.2.2 Using a stopwatch, time the inspiratory phase.

6.18.2.3 What is the inspiratory time? ___ seconds (1.8-2.2)

6.18.2.4 Using a stopwatch, time the expiratory phase.

6.18.2.5 What is the expiratory time? ___ seconds (3.6-4.4)

(✓) 6.18.3 Frequency Test

6.18.3.1 Adjust the FREQUENCY and I:E RATIO through the following settings:

FREQUENCY	I:E RATIO
11	1:1
22	1:1.5
33	1:2
44	1:2.5
55	1:3
66	1:3.5
77	1:4
88	1:4.5
99	1:4.5

6.18.3.2 Does the ventilator cycle properly? ___ (Y)

(✓) 6.18.4 "F" Bellows Test

6.18.4.1 Set the FREQUENCY to 10.

6.18.4.2 Set the I:E RATIO to 1:2.

6.18.4.3 Adjust the O_2 flow to 300 ml.

6.18.4.4 Adjust the INSPIRATORY FLOW to MED.

6.18.4.5 Adjust the Tidal Volume to 200 ml.

6.18.4.6 What is the Tidal Volume on the Spiromed(B)? ___ ml (125-250)

6.18.4.7 this step intentionally left blank

6.18.4.8 this step intentionally left blank

6.18.4.9 Adjust the Tidal Volume to 1000 ml.

6.18.4.10 What is the Tidal Volume on the Spiromed(B)? ___ ml (900-1100)

6.18.4.11 Adjust the INSPIRATORY FLOW to HIGH.

6.18.4.12 this step intentionally left blank

6.18.4.13 this step intentionally left blank

6.18.4.14 Adjust the O_2 flow to 5 lpm.

6.18.4.15 this step intentionally left blank.

6.18.4.16 Adjust the Tidal Volume to maximum.

6.18.4.17 What is the Tidal Volume on the test volumeter? ___ ml ($\geq$1400)

(✓) 6.19 Ventilator Relief Valve Test

6.19.1 Adjust the O_2 flow to 10 lpm.

6.19.2 Adjust the INSPIRATORY FLOW to MED.

6.19.3 Adjust the I:E RATIO to 1:3.

6.19.4 Adjust the Tidal Volume to 1200 ml.

6.19.5 What is the PEEP? ___ cm H_2O (≤3)

6.19.6 Adjust the O_2 flow to 500 ml.

6.19.7 Does the ventilator deliver the full 1200 ml Tidal Volume during 5 consecutive cycles? ___ (Y)

6.19.8 Does the bellows stop adjust smoothly? ___ (Y)

(✓) 6.20 Bellows Drive Gas Leak Test

6.20.1 Remove the ventilator hose from the bellows assembly.

6.20.2 Attach a test terminal to the bellows assembly.

6.20.3 Attach a Capnomed flowmeter test stand to the test terminal.

6.20.4 Set the BPM to 1.

6.20.5 Set the I:E Ratio to 1:1.

6.20.6 Set the flow to the maximum.

6.20.7 What is the volume that is registered during the inspiratory phase? ___(<50 ml)

6.20.8 Remove the test terminal and flowmeter test stand. Connect the ventilator hose to the VENTILATOR HOSE terminal.

(✓) 6.21 Bellows PEEP Valve Test (If Applicable)

6.21.1 Adjust the oxygen flow to 5 lpm.

6.21.2 Adjust the PEEP valve clockwise to the maximum position.

6.21.3 What is the PEEP on the absorber pressure gauge? ___ cm H_2O (18-25)

6.21.4 Adjust the PEEP valve counterclockwise to the minimum position.

6.21.5 Close the O_2 flow control valve.

(✓) 6.22 Pressure Limit Control Test (If Applicable)

6.22.1 Set the Inspiratory Flow to the botom of the LOW range.

6.22.2 Set the oxygen flow rate to 4 l/min.

6.22.3 Set the Pressure Limit Control to the MAX position.

6.22.4 Occlude the Y-piece with your thumb.

6.22.5 Slowly increase the Inspiratory Flow setting until a pressure of 80 cm H_2O is achieved.

6.22.6 Set the Pressure Limit Control to 30.

6.22.7 What is the peak pressure? ___ cm H_2O (27-33)

6.22.8 Set the Pressure Limit Control to the MIN position.

6.22.9 What is the peak pressure? ___ cm H_2O (9-15)

6.22.10 Remove your thumb from the Y-piece.

6.22.11 Set the INSPIRATORY FLOW to the maximum of the LOW zone.

6.22.12 Close the oxygen flow control valve.

6.22.13 Turn the ventilator off.

NOTE: The INSPIRATORY FLOW gauge will not return to the stop position when the ventilator is turned off.

(✓) 6.23 Trace Functions

6.23.1 Press the TRACE key to bring up a trace display on the data CRT.

6.23.2 Press the Upper Trace Selection key repeatedly and ensure that all of the available choices are sequentially displayed directly above the key. Press the ENTER key to set the upper trace display to the trace selection.

6.23.3 Press the Lower Trace Selection key repeatedly and ensure that all of the available choices are sequentially displayed directly above the key. Press the ENTER key to set the lower trace display to the trace selection.

6.23.4 Press the Sweep Speed Selection key and ensure that the message displayed above the key toggles between SLOW and FAST. Verify that the trace sweep speed changes accordingly -
Fast: 8 Sec.; Slow: 16 Sec.

6.23.5 Press the Waveform Sweep/Freeze key and ensure that the message displayed above the key toggles between SWEEP and FREEZE. Verify that the trace display changes accordingly.

(✓) 6.24 Trend Functions

6.24.1 Press the TREND key to bring up the trend display.

6.24.2 Press the key below the box on the right side of the screen repeatedly and verify that the screen selection cycles through all four choices, and finally select SET UP TREND.

6.24.3 Press the ENTER key to bring up the Set Up Trend screen.

6.24.4 Press the key below each column on the screen and ensure that each cursor moves through all of the choices.

6.24.5 Choose a configuration and press the ENTER key. Verify that the corresponding trend display appears.

6.24.6 Press the key below the box on the right side of the trend screen, and select SET UP DATA LOG.

6.24.7 Press the ENTER key to display the Set Up Data screen.

6.24.8 Press the key below each column on the screen and ensure that each cursor moves through all of the choices.

6.24.9 Select EXIT and press the ENTER key to return to the trend screen.

6.24.10 Press the key below the box on the right side of the trend screen, and select DISPLAY DATA LOG. Verify that the Tabular Data Log screen is correctly displayed.

6.24.11 Press the key below EXIT to return to the trend screen.

(✓) 6.25 Spiromed Monitor (if applicable)

6.25.1 Press the LO minute volume alarm key.

6.25.2 Verify that the minute volume has a low alarm limit range from 0.5 to 10.0 by increments of 0.5.

6.25.3 Adjust the low minute volume alarm to 2.0 liters.

6.25.4 Press the VOLUME ALARMS DISABLE key to enable the volume alarms, and start a stopwatch.

6.25.5 What is the time when the "APNEA-VOL" is activated in the CAUTION column? ___ sec (13-17)

6.25.6 What is the time when the "APNEA-VOL" is activated in the WARNING column? ___ sec (27-33)

6.25.7 Insert a calibrated volumeter in between the Spiromed sensor and the exhalation valve.

6.25.8 Attach a patient circuit to the absorber system.

6.25.9 Turn the ventilator ON.

6.25.10 Adjust the FREQUENCY to 6.

6.25.11 Adjust the I:E RATIO to 1:2.

6.25.12 Adjust the flow to the maximum of the LOW zone.

6.25.13 Adjust the oxygen flow to 2 lpm.

6.25.14 Adjust the Tidal Volume to 200 ml.

6.25.15 After the first breath is detected, does the "APNEA-VOL" in the WARNING column and the "MIN VOL LOW" in the CAUTION column deactivate? ___ (Y)

6.25.16 After one (1) minute, does the "MIN VOL LOW" message appear in the CAUTION column? ___ (Y)

6.25.17 Adjust the low alarm limit 0.1 liter below the indicated minute volume.

6.25.18 Does the "MIN VOL LOW" in the CAUTION column deactivate? ___ (Y)

6.25.19 Increase the tidal volume to 1000 ml and the frequency to 10 BPM.

6.25.20 Are the tidal volumes on the Spiromed and on the volumeter within 20% of each other? ___ (Y)

6.25.21 Are the minute volumes on the Spiromed and on the volumeter within 20% of each other? ___ (Y)

6.25.22 Create a reverse flow by loosening the expiratory valve dome.

6.25.23 Each time a reverse flow greater than 20 ml is detected, does the "REVERSE FLOW" message appear in the ADVISORY column? ___ (Y)

6.25.24 Tighten the expiratory valve dome.

6.25.25 Disconnect the Spiromed sensor from the VOLUME SENSOR interface.

6.25.26 Do the "VOL SEN DISC" and "VOL ALRM OFF" messages appear in the ADVISORY column? ___ (Y)

6.25.27 Connect the Spiromed sensor to the VOLUME SENSOR interface.

6.25.28 Turn off the ventilator.

6.25.29 Press the VOLUME ALARMS DISABLE key to disable the volume alarms.

(✓) 6.26 Alarm Circuit Delay Test

6.26.1 Verify the 120-second audio delay at power-up.

6.26.2 Press the alarm silence key.

6.26.3 Does the SILENCE 60 message appear in the Advisory column? ___(Y)

6.26.4 Does the SILENCE message count down to 0 and then disappear? ___(Y)

6.26.5 Press the alarm silence key twice.

6.26.6 Does the SILENCE 120 message appear in the Advisory column? ___(Y)

6.26.7 Press the key labeled with a speaker.

6.26.8 Does the SILENCE message disappear from the Advisory column? ___(Y)

6.26.9 Press the VOLUME ALARMS DISABLE key to disable the volume alarms.

(✓) 6.27 BAROMED Monitor Calibration

6.27.1 Turn the System Power switch to ON.

Press the THRESHOLD key (labeled with a pressure waveform).

Adjust the threshold to 8 cm H_2O.

Press the HI pressure alarm limit key.

6.27.2 Set the high alarm limit to 65 cm H_2O.

6.27.3 Press the APNEA ALARM DISABLE key to enable the alarms.

(✓) 6.27.4 After the "APNEA-PRES" alarm is displayed in the Warning column of the alarm CRT, slowly increase the pressure using a pressure switch tester or test gauge.

At what pressure does the "APNEA-PRES" alarm deactivate? ___ cm H_2O (6-10)

Increase the pressure to 30 cm H_2O.

Bleed the pressure and start a stopwatch.

(✓) 6.27.5 What is the time when the "APNEA-PRES" is activated in the Caution column? ___ (13-17)

(✓) 6.27.6 What is the time when the "APNEA-PRES" is activated in the Warning column? ___ (26-34)

6.27.7 Does the "THRESHOLD LO" message appear in the Advisory column? ___ (Y)

6.27.8 Adjust the threshold to 26 cm H_2O.

(✓) 6.27.9 Repeat Steps 6.27.5 thru 6.27.7.

6.27.10 Adjust the threshold to 12 cm H_2O.

(✓) 6.27.11 Repeat Steps 6.27.5 thru 6.27.7.

6.28 Continuing Pressure Alarm

6.28.1 Increase the pressure to 20 cm H_2O, maintain the pressure, and start a stopwatch.

(✓) 6.28.2 What is the time when the "CONTG PRES" alarm is activated in the Caution column? ___ sec (12-18)

(✓) 6.28.3 Decreasing the pressure slowly, what is the pressure at which the "CONTG PRES" alarm deactivates? ___ cm H_2O (10-14)

6.29 High Pressure Alarm

6.29.1 Slowly increase the pressure.

(✓) 6.29.2 At what pressure does the "VENT PRES HI" alarm activate? ___ cm H_2O (63-67)

6.29.3 Bleed the pressure.

6.30 Sub-Atmospheric Pressure Alarm

6.30.1 Slowly create a sub-atmospheric pressure.

(✓) 6.30.2 At what pressure does the "SUB ATM PRES" alarm activate? ___ cm H_2O (-7 to -12)

6.30.3 Disconnect the test gauge and connect the breathing hose.

6.30.4 Press the APNEA ALARM DISABLE key to disable the apnea alarms.

(✓) 6.31 Oxygen Ratio Monitor Control Test

6.31.1 Open the oxygen and nitrous oxide cylinder valves.

6.31.2 Depress the "O_2 FLUSH" for 15 seconds.

6.31.3 Turn the N_2O flow control valve counter-clockwise to its stop position.

6.31.4 Slowly increase the oxygen flow until nitrous oxide begins to flow.

6.31.5 What is the oxygen flow rate? ___(200-300 ml/min.)

6.31.6 Slowly increase the oxygen flow until the "O_2/N_2O FLOW RATIO" LED on the alarm panel is lighted.

6.31.7 What is the nitrous oxide flow rate? ___(150-300 ml/min.)

6.31.8 Set the oxygen flow to 1000 ml/min.

6.31.9 Adjust the nitrous oxide flow until the ORMc controls the nitrous oxide.

6.31.10 What is the oxygen concentration? ___ % (21-29)

6.31.11 Does the "O_2/N_2O FLOW RATIO" LED turn "ON" on the ALARM PANEL? ___ (Y)

6.31.12 Does the "O_2/N_2O LOW" message appear in the ADVISORY column? ___ (Y)

6.31.13 Open the nitrous oxide flow control valve to the stop position.

6.31.14 Adjust the oxygen flow to 1.5 l/min.

6.31.15 What is the oxygen concentration? ___ % (21-29)

6.31.16 Adjust the oxygen flow to 2 l/min.

6.31.17 What is the oxygen concentration? ___ % (21-29)

6.31.18 Adjust the oxygen flow to 3 l/min.

6.31.19 What is the oxygen concentration? ___ % (21-29)

6.31.20 Set the LOCK OUT device to "ALL GASES".

6.31.21 Is the "O_2/N_2O FLOW RATIO" alarm activated? ___ (N)

6.31.22 Set the LOCK OUT device to "O_2+N_2O".

6.31.23 Close the oxygen flow control valve.

6.31.24 What is the flow of nitrous oxide? ___ ml/min. (0)

6.31.25 Is the "O_2/N_2O FLOW RATIO" alarm activated? ___ (N)

6.31.26 Close the nitrous oxide flow control valve.

6.31.27 Turn the System Power switch to STANDBY.

(✓) 6.32 Scavenger Interface (if applicable)

6.32.1 Check all scavenger hoses and reservoir bag for deterioration. Replace all worn components.

6.32.2 Negative Relief Valve Cleaning:

6.32.2.1 Remove the plastic valve cover on the front surface of the scavenger body by turning it in a counter-clockwise direction.

6.32.2.2 Remove the valve and washer from the scavenger body by turning it counter-clockwise. A needle-nose pliers may be used to turn the valve, but use care not to damage the valve's fragile disk.

6.32.2.3 Brush any accumulated lint or dust off the valve with a soft brush. The valve may be further cleaned with a low flow of clean air or oxygen.

6.32.2.4 Reinstall the plastic washer and valve into the scavenger body. Replace the valve cover.

6.32.3 Negative Relief Safety Valve Cleaning:

6.32.3.1 Unscrew the chrome plated valve housing on the left side of the scavenger body by turning its fitting counter-clockwise with a wrench.

6.32.3.2 Unscrew the valve from the housing by turning it in a counter-clockwise direction.

6.32.3.3 Brush any accumulated lint or dust off the valve with a soft brush. The valve may be further cleaned with a low flow of clean air or oxygen.

6.32.3.4 Reinstall the valve in the housing, and then reinstall the housing into the scavenger body. Note: This valve does not require washers or O-rings.

6.32.4 Positive Relief Valve Cleaning:

6.32.4.1 Remove the valve housing on the right side of the scavenger body by turning it counter-clockwise.

6.32.4.2 Inspect the rubber O-ring and replace if worn.

6.32.4.3 Remove the valve from the housing by turning it counter-clockwise. A needle-nose pliers may be used to turn the valve, but use care not to damage the valve's fragile disk.

6.32.4.4 Brush any accumulated lint or dust off the valve with a soft brush. The valve may be further cleaned with a low flow of clean air or oxygen.

6.32.4.5 Reinstall the valve and plastic washer into the housing.

6.32.4.6 Reinstall the valve housing onto the scavenger body, making sure that the O-ring is properly seated.

6.32.5 Negative Pressure Test:

6.32.5.1 Connect a 22mm breathing hose between the absorber's inspiratory and expiratory valves. Set the Man/Auto valve to the BAG position. Turn the APL valve fully counter-clockwise. Occlude the bag mount connector.

6.32.5.2 Verify that the suction waste gas disposal system is active.

6.32.5.3 Close all flow control valves on the machine. Adjust the scavenger needle valve to allow typical suction through the scavenger.

6.32.5.4 Install a scavenger adapter (P/N 4108114) with a hose barb between the 19mm hose terminal of the scavenger and the scavenger hose. Connect a test monitor to the hose barb adapter and observe the pressure reading on the test gauge. The gauge shall indicate a pressure of <-1.0 cmH_2O.

6.32.6 Positive Pressure Test:

6.32.6.1 Close the scavenger needle valve by turning it fully clockwise.

6.32.6.2 Push the O_2 Flush button to inflate the scavenger reservoir bag. Open the oxygen flow control valve to 10 l/min.

6.32.6.3 Observe the pressure reading on the test gauge. The gauge shall indicate a pressure of <10.0 cmH_2O.

6.32.6.4 Remove the test equipment. Readjust the scavenger needle valve to allow typical suction through the scavenger.

(✓) 6.33 Scavenger, A/C (if applicable)

6.33.1 Remove all scavenger hoses one at a time, and drain all accumulated moisture. Inspect all scavenger hoses for deterioration and replace any worn hoses.

6.33.2 Remove the safety relief valve housing by unscrewing it in a counter-clockwise direction.

6.33.3 Inspect the rubber O-ring and replace if worn.

6.33.4 Remove the safety relief valve from its housing by twisting it out in a counter-clockwise direction. The tips of needle-nose pliers can be used to turn the valve. Be careful not to damage the valve disk.

6.33.5 Remove any accumulated lint or dust from the valve with a soft brush. The valve may be further cleaned with a low flow of clean air or oxygen. The scavenger body can be cleaned with a moist cloth.

6.33.6 Reinstall the valve into the housing, making sure that it is threaded all the way into the housing and that the plastic washer is properly seated on its upper surface.

6.33.7 Make sure that the interior of the valve body is completely dry. Reinstall the valve housing onto the scavenger body, making sure that the O-ring is properly seated.

6.33.8 Perform the following Pre-Use Checkout procedure:

6.33.8.1 Connect a 19 mm scavenger hose between the bottom of the absorber pole and the right-hand port on the scavenger. Connect a short 19 mm scavenger hose between the APL valve and the port on the rear of the absorber pole. Connect a 19 mm scavenger hose between the ventilator relief valve and the left-hand port on the scavenger.

6.33.8.2 Connect a short 22 mm breathing hose from the inspiratory valve to the expiratory valve on the absorber.

6.33.8.3 Set the Man/Auto valve to the AUTO position.

6.33.8.4 If the absorber system or ventilator bellows are equipped with a PEEP valve, turn the PEEP valve control knob fully counter-clockwise.

6.33.8.5 Open the oxygen flow control valve to a flow of 10 l/min. and occlude the 19 mm scavenger terminal labeled EXHAUST.

6.33.8.6 After the ventilator bellows inflates, the flow of oxygen will exit the system through the positive pressure safety relief valve. At this point, the absorber system breathing pressure gauge shall indicate a pressure of 10.0 cm H_2O or less.

(✓) 6.34 Open Reservoir Scavenger (if applicable)

6.34.1 Remove all scavenger hoses one at a time and drain all accumulated moisture. Inspect all scavenger hoses for deterioration and replace any worn hoses.

6.34.2 Disconnect the hospital vacuum source from the scavenger.

6.34.3 Remove the scavenger flow control needle valve assembly. Inspect the needle valve and seat for lint or dust accumulation. Clean with compressed air if necessary, and reinstall the needle valve assembly.

6.34.4 Remove the scavenger mounting screws.

6.34.5 Remove the two screws securing the access panel at the bottom of the scavenger canister.

6.34.6 Remove and inspect the silencer; replace if needed.

6.34.7 Remove the reservoir canister from the scavenger body by unscrewing the four socket head cap screws located at the top of the canister.

6.34.8 Remove the flowmeter from its housing by turning it counter-clockwise. Inspect the tube and clean with compressed air if needed.

6.34.9 Reassemble the scavenger assembly, and reactivate the vacuum source.

6.34.10 Perform the following negative pressure relief test:

6.34.10.1 Connect a 19 mm scavenger hose between the bottom of the absorber pole and the right-hand port on the scavenger. Connect a 19 mm scavenger hose between the APL valve and the rear port on the absorber pole. The left-hand scavenger port may be capped for this test, or may be connected to the ventilator relief valve. Connect a DISS vacuum hose to the threaded terminal on the left side of the scavenger. Alternatively, an adapter can be used to attach a wall suction hose to the hose barb fitting on the adapter.

6.34.10.2 Connect a short 22 mm breathing hose from the inspiratory valve to the expiratory valve on the absorber. Set the Man/Auto selector valve to the BAG position. Turn the APL valve control knob fully counter-clockwise.

6.34.10.3 Verify that the suction waste gas disposal system is active.

6.34.10.4 Adjust the scavenger needle valve until the flowmeter indicates between the white lines. Close all flow control valves on the anesthesia machine. Occlude the absorber breathing bag terminal.

6.34.10.5 Install a scavenger adapter with a hose barb between the 19 mm hose terminal of the scavenger, and the scavenger hose. Connect a test pressure monitor to the hose barb on the adapter and observe the pressure reading on the test gauge. The gauge shall indicate a pressure of 0 to -0.5 cm H_2O.

6.34.11 Perform the following positive pressure relief test:

6.34.11.1 Perform Steps 6.30.10.1 thru 6.30.10.3.

6.34.11.2 If the absorber system or ventilator bellows are equipped with a PEEP valve, turn the PEEP valve control knob fully counter-clockwise.

6.34.11.3 Turn the scavenger needle valve fully clockwise (closed).

6.34.11.4 Open the oxygen flow control valve on the anesthesia machine to a flow of 10 l/min. and occlude the absorber breathing bag terminal.

6.34.11.5 The flow of oxygen shall now exit the system through the relief ports around the top of the canister. The test pressure gauge shall indicate a pressure less than 1.0 cm H_2O.

6.34.11.6 After the test, adjust the scavenger needle valve for a flowmeter indication halfway between the two white lines.

6.35 Sphygmomed

6.35.1 Press the START key and verify that the green LED is lighted,and that the pump begins to inflate the cuff. After the monitor detects that the cuff is either disconnected, applied wrong, or has a leak, the pump should stop. The Start LED should extinguish, and the yellow BP ERROR should be lighted.

6.35.2 The CRT shall display a "BP CUFF ERR" message under the Advisory column.

6.35.3 Turn the System Power switch to STANDBY. Wrap the cuff loosely around a cylindrical object. Attach, in series, a calibrated manometer between the patient cuff and the hose assembly.

6.35.4 Press and hold the [▲] and [▼] keys, and turn the System Power switch to ON.

6.35.5 The cuff shall inflate to 180 to 190 mm Hg in 4 seconds or less. The manometer shall indicate ±2 mm Hg, and the pressure shall not drop more than 3 mm Hg before the system deflates. The cuff should deflate 29 to 31 seconds after the start of inflation. Remove the cuff from the cylindrical object.

6.35.6 Turn the System Power switch to STANDBY.

6.35.7 Turn the System Power switch to ON.

6.35.8 Install the BP cuff on your left arm.

6.35.9 Press the DISPLAY key and set the interval to 5 minutes.

6.35.10 Press the START key.

6.35.11 When the cuff cycle is complete, press the LO key and set the alarm limit to above the actual value. Decrease the setting to below actual value; the alarm should cease.

6.35.12 Press the HI key and set the alarm limit to below actual value. Increase the setting to above actual value; the alarm should cease.

6.35.13 Press the STAT key. The cuff should inflate. The time between deflation and the next inflation shall be 3 seconds.

6.35.14 Press the STOP key.

6.36 Nellcor O2 SatMed - if applicable

6.36.1 Enable the SaO_2 alarms by pressing the SaO_2 DISABLE key.

6.36.2 Attach sensor to finger and obtain pulse and SaO_2 readings.

6.36.3 Remove sensor from finger. After 10 seconds, the red Pulse Low LED will be flashing and a continuous audible alarm will be activated.

6.36.4 The Central Alarm CRT will display "NO OXI PULSE" under the flashing Warning heading.

6.36.5 Disconnect the sensor from the preamp.

(✓) 6.36.6 Connect a Nellcor PT 2500 Pocket Tester to the preamp and verify that SaO_2 reading is 81 ±1 and pulse reading is 44 ±1.

6.36.7 Raise the low pulse alarm limit above the actual rate.

6.36.8 The Pulse Low LED will flash red and a continuous audible alarm will be heard. The Alarm CRT will display "OXI PULSE LOW".

6.36.9 Return the low alarm limit to its original default setting.

6.36.10 Decrease the high pulse alarm limit below the actual pulse rate.

6.36.11 The pulse high LED will illuminate and an intermittent audible alarm will be heard. The Alarm CRT will display "OXI PULSE HI".

6.36.12 Return the pulse high alarm limit to its original default setting.

6.36.13 Press the DISPLAY key and verify that SaO_2% is displayed.

6.36.14 Press the LO key, and increase the SaO_2% low alarm limit above the actual reading.

6.36.15 The SaO_2 LED will flash red, and a continuous audible alarm will sound. The Alarm CRT will display "OXI SAT LOW" in the Warning column.

6.36.16 Return the low SaO_2 low alarm limit to its original default setting.

6.36.17 Press the HI key, and decrease the SaO_2 high alarm limit below the actual reading.

NOTE: The monitor will not display any visual alarms.

6.36.18 An intermittent audible alarm will sound. The Alarm CRT will display "OXI SAT HIGH".

6.36.19 Return the high SaO_2 alarm limit to its original default setting.

6.36.20 Remove the Pocket Tester from the preamp, and reconnect the finger probe.

6.36.21 Disable the SaO_2 alarms.

6.36A Novametrix O2 SatMed - if applicable

6.36A.1 Enable the SaO_2 alarms by pressing the SaO_2 DISABLE key.

6.36A.2 Attach sensor to finger and obtain pulse and SaO_2 readings.

6.36A.3 Remove sensor from finger. After 10 seconds, the red Pulse Low LED will be flashing and a continuous audible alarm will be activated.

6.36A.4 The Central Alarm CRT will display "NO OXI PULSE" under the flashing Warning heading.

6.36A.5 Disconnect the sensor from the extension cable.

6.36A.6 Connect a Novametrix TB500B Sensor Simulator to the SpO2 extension cable. Set the Sensor Type switch to 87XX. Set the output signal to 3 and the saturation to 82%. Turn the simulator ON and verify that the monitor's displayed Pulse reading is 60 ±1 BPM and the SaO2 reding is 82 ±2.

NOTE: Do not rely on the simulator's low battery LED as an indicator of sufficient battery power. Replace the battery with a fresh 9 volt transistor battery if proper measured values are not obtained and the battery measures ≤8.5 VDC.

6.36A.7 Adjust the simulator's saturation setting to 100 and verify that the monitor indicates 99 ±1. Adjust the saturation to 62 and verify that the monitor indicates 62 ±2.

6.36A.8 Depress the Open Test RED key and verify that the PULSE LO LED activates, a continuous audible alarm is heard, and a NO OXI PULSE warning alarm is displayed on the CRT. Release the test key.

6.36A.9 Depress the Open Test INFRARED key and verify that the same alarm results occur as in the previous test.

6.36A.10 Depress both Open Test keys together and verify the monitors SaO2 and OXI ALARMS DISABLE indicators activate, a single audible tone is heard, and OXI SEN DISC advisory alarm is displayed on the CRT. Release the Open Test keys.

6.36A.11 Raise the low pulse alarm limit above the actual rate.

6.36A.12 The Pulse Low LED will flash red and a continuous audible alarm will be heard. The Alarm CRT will display OXI PULSE LOW.

6.36A.13 Return the low alarm limit to its original default setting.

6.36A.14 Decrease the high pulse alarm limit below the actual pulse rate.

6.36A.15 The pulse high LED will illuminate and an intermittent audible alarm will be heard. The Alarm CRT will display "OXI PULSE HI".

6.36A.16 Return the pulse high alarm limit to its original default setting.

6.36A.17 Press the DISPLAY key and verify that SaO_2% is displayed.

6.36A.18 Press the LO key, and increase the SaO_2% low alarm limit above the actual reading.

6.36A.19 The SaO_2 LED will flash red, and a continuous audible alarm will sound. The Alarm CRT will display "OXI SAT LOW" in the Warning column.

6.36A.20 Return the low SaO_2 low alarm limit to its original default setting.

6.36A.21 Press the HI key, and decrease the SaO_2 high alarm limit below the actual reading.

NOTE: The monitor will not display any visual alarms.

6.36A.22 An intermittent audible alarm will sound. The Alarm CRT will display "OXI SAT HIGH".

6.36A.23 Return the high SaO_2 alarm limit to its original default setting.

6.36A.24 Remove the Pocket Tester from the preamp, and reconnect the finger probe.

6.36A.25 Disable the SaO_2 alarms.

6.37 Capnomed CO2 Monitor (if applicable)

6.37.1 Disconnect the scavenger adapter hose from the exhaust port on the sensor interface panel.

6.37.2 Connect a capnomed flowmeter test stand to the exhaust port.

(✓) 6.37.3 Verify that the sample flow rate is 150 ±25 ml/min. with all traps and sample lines attached at the patient interface panel.

6.37.4 Disconnect the sample line and semi-permeable tube from the auxiliary water trap.

6.37.5 Connect the sample line to the semi-permeable tubing.

6.37.6 Occlude the sample line at the airway adapter and verify that the LINE BLOCK alarm lamp is lighted, and that "CO2 LINE BLK" and "CO2 ALRM OFF" messages appear on the CRT in the Advisory column.

6.37.7 Verify that the test flowmeter reads 0 ml/min.

6.37.8 Remove the occlusion from the sample line.

6.37.9 Turn the System Power switch to STANDBY.

6.37.10 Press and hold the ▲ and ▼ keys on the monitor, and turn the System Power switch to ON. Allow 10 minutes for the system to stabilize.

6.37.11 Press the CAL key on the monitor. The monitor window will show flashing 00, then steady 00.

6.37.12 Connect a calibration gas adapter (P/N 4110216) to a calibration gas cylinder (P/N 4107979).

6.37.13 Connect the luer-lock fitting on the calibration gas adapter to the sample line.

6.37.14 Open the valve on the calibration gas adapter.

6.37.15 Press the DISPLAY key on the monitor; a flashing 38 will appear in the monitor window.

6.37.16 After 30 seconds, the cal key indicator will be lighted. Press the CAL key; the 38 display will stop flashing.

6.37.17 Close the valve on the calibration gas adapter.

6.37.18 Turn the System Power switch to STANDBY, then return the switch to ON. Wait 10 minutes.

6.37.19 Open the valve on the calibration gas adapter. Wait 15 seconds.

(✓) 6.37.20 Disconnect the luer-lock fitting on the sample line from the calibration gas adapter. Verify that the monitor indicates 38 ±2 mm Hg.

6.37.21 Close the valve on the calibration gas adapter.

6.37.22 Disconnect the test flowmeter from the exhaust port and reconnect the scavenger adapter hose to the exhaust port.

6.37.23 Connect a 3/16 hose barb with a short length of tubing and a male Luer fitting to the port at the top of the flow meter test stand.

6.37.24 Remove the sample line and connect the Luer fitting on the flow meter to the plastic Luer fitting on the auxiliary water reservoir.

6.37.25 Occlude the male Luer connector on the auxiliary water trap bracket.

6.37.26 Verify a flow of 35 - 60 ml/min. with a vacuum supply of 375 mm Hg.

6.37.27 Disconnect the test flowmeter. Reconnect the sample line to the auxiliary water trap reservoir.

6.37.28 Reconnect the semi-permeable tube to the auxiliary water trap bracket.

6.37.29 Connect the sample line to the luer-lock fitting on the calibration gas adapter.

6.37.30 Open the valve on the calibration gas adapter a small amount. Wait for the displayed CO_2 waveform to stabilize.

6.37.31 Disconnect the sample line from the calibration gas adapter.

6.37.32 Verify an $ETCO_2$ value of 38 ±2 mm Hg on the monitor display.

6.37.33 Press the HI key, and set the alarm default value to 35 mm Hg.

6.37.34 Enable the CO_2 alarm.

6.37.35 Repeat Steps 29 thru 31.

6.37.36 The red CO_2 HI lamp will light continuously; an "ET CO2 HIGH" message will appear on the CRT in the Caution column, and an intermittent audible alarm will sound.

6.37.37 Return the high alarm limit to its original default setting.

6.37.38 Press the LO key, and set the low alarm limit to 41.

6.37.39 Repeat Steps 29 thru 31.

6.37.40 The red CO_2 LOW lamp will light continuously, and an "ET CO2 LOW" message will appear on the CRT in the Caution column.

6.37.41 Return the low alarm limit to its original default setting.

6.37.42 Repeat Steps 29 thru 31.

6.37.43 When an $ETCO_2$ value is displayed, start a stop watch.

6.37.44 After 15 seconds, the red APNEA indicator will light continuously; an "APNEA - CO2" message will appear on the CRT in the Caution column, and an intermittent audible alarm will sound.

6.37.45 After another 15 seconds, the red APNEA indicator will flash, the "APNEA - CO2" message will move to the Warning column, and the audible alarm will sound continuously.

6.37.46 Disable the CO_2 alarms.

(✓) 6.38 Vapor Exclusion System (and Indicator Lamps if applicable)

6.38.1 Set all vapors to zero (0).

6.38.2 Adjust the handwheel on the left position vapor to any concentration above zero (0).

* 6.38.3 Verify that the yellow indicator lamp above the left position vaporizer is illuminated. Press AGENT SELECT on the multispec monitor and verify the correct blinking agent initial in the monitor window.

6.38.4 Is it possible to adjust the middle position vapor? ___ (N)

6.38.5 Is it possible to adjust the right position vapor? ___ (N)

6.38.6 Adjust the handwheel on the left position vapor to zero (0).

6.38.7 Adjust the handwheel on the middle position vapor to any concentration above zero (0).

* 6.38.8 Verify that the yellow indicator lamp above the center vaporizer is illuminated. Press AGENT SELECT on the multispec monitor and verify the correct blinking agent initial in the monitor window.

6.38.9 Is it possible to adjust the left position vapor? ___ (N)

6.38.10 Is it possible to adjust the right position vapor? ___ (N).

6.38.11 Adjust the handwheel on the middle position vapor to zero (0).

6.38.12 Adjust the handwheel on the right position to any concentration above zero (0).

* 6.38.13 Verify that the yellow indicator lamp above the right position vaporizer is illuminated. Press AGENT SELECT on the multispec monitor and verify the correct blinking agent initial in the monitor window.

6.38.14 Is it possible to adjust the left position vapor? ___ (N).

6.38.15 Is it possible to adjust the middle position vapor? ___ (N).

6.38.16 Adjust the handwheel on the right position vapor to zero (0).

* Denotes Agent Order Indicators test.

6.39 Multispec (if applicable)

6.39.1 Intentionally left blank

NOTE: Before performing the accuracy test, the Multispec must be in the full accuracy mode. The CO_2 and Agent warm-up messages shall not appear on the advisory display.

NOTE: Before performing the accuracy test, the oxygen analyzer must display 21% FIO_2. The sensor must be exposed to ambient air during the entire Multispec accuracy testing.

6.39.2 Sample Flow Test

6.39.2.1 Verify that the neonatal mode is disabled.

6.39.2.2 Verify that an oxygen supply is connected to the machine.

6.39.2.3 Examine the sample circuit consisting of the airway adapter/filter, sample line, and auxiliary water trap. Replace any components as needed.

6.39.2.4 Connect a capnomed flowmeter test stand to the patient sample exhaust port.

(✓) 6.39.2.5 Verify that the sample flow is within 175 to 225 ml/min.

(✓) 6.39.3 Line Block Test

6.39.3.1 Remove the calibration gas cylinder from the multispec calibration adapter.

6.39.3.2 Set both flow control valves on the multispec calibration adapter fully counter-clockwise.

6.39.3.3 Attach the patient sample line to the luer lock fitting on the calibration adapter.

6.39.3.4 Turn the flow control valve clockwise until the capnomed flowmeter indicates 75 ml/min.

6.39.3.5 Verify that the letters LL appear in the monitor display window after approximately 15 seconds.

(✓) 6.39.4 Auxiliary Water Trap Test Procedure (if applicable)

6.39.4.1 Disconnect the test flowmeter from the exhaust port and reconnect the scavenger adapter hose to the exhaust port.

6.39.4.2 Connect a 3/16 in. hose barb with a short length of tubing and a male Luer fitting to the port at the top of the flow meter test stand.

6.39.4.3 Remove the patient sample line and connect the Luer fitting of the test stand to the plastic Luer fitting on the auxiliary reservoir.

6.39.4.4 Occlude the male Luer connector of the auxiliary water trap bracket

6.39.4.5 Verify a flow of 35 to 60 ml/min. with a scavenger system supply vacuum of 375 Hg.

6.39.4.6 Disconnect the test flowmeter. Reconnect the sample line to the reservoir.

6.39.4.7 Reconnect the semi-permeable tube to the auxiliary water trap bracket.

NOTE: Before performing the Multispec accuracy test, the vaporizers must be exposed to a constant temperature (preferably 22° C) for at least one hour. The Multispec analyzer must be in the full accuracy mode.

(✓) 6.39.5 Accuracy Test

6.39.5.1 Verify that CO_2 and AGT Warmup messages are not on the CRT advisory screen.

6.39.5.2 Press the "CO2/AGENT CAL" key on the monitor PANEL. Verify that CO_2 CAL appears on the CRT and that CAL key illuminates.

6.39.5.3 Press the "SELECT" key and configure the monitor display to indicate "H".

6.39.5.4 Attach the CO_2 calibration adapter assembly (P/N 4110216 A) to the CO_2 calibration cylinder (P/N 4107979 P)

6.39.5.5 Turn the flow control valve on the calibration adapter slightly counter-clockwise.

6.39.5.6 After the CO_2 waveform peaks on the remote display, turn off the flow and remove the sample line from the calibration adapter.

6.39.5.7 Verify that the ET CO_2 display indicates within 36.0 to 40.0 mm Hg.

6.39.5.8 Press the monitor Display key to scroll to ET AGENT.

6.39.5.9 Verify that the "ET" halothane on the agent display indicates within 0 to 0.4%

6.39.5.10 Verify that the "EXP" N_2O indicates within 32.0 to 38.0% on the data CRT.

6.39.5.11 Press the TRACE keypad. Using the arrow keys below the Trace CRT, select the HALOTHANE scale.

6.39.5.12 Ensure that all vaporizer handwheels are set to the zero, or OFF position.

6.39.5.13 Fill each vaporizer with the correct anesthetic agent until the liquid level is within the correct range as indicated on the sight glass. DO NOT OVER FILL.

6.39.5.14 Calibrate a Riken gas indicator Model 18 as per manufacturer's instructions.

6.39.5.15 Insert the patient circuit elbow into the fresh gas outlet.

6.39.5.16 Connect a sampling "T" between the elbow and the fresh gas hose.

6.39.5.17 Turn the APL valve knob fully counter-clockwise to its open position.

6.39.5.18 Attach a short 22 mm hose between the inspiratory and expiratory valves.

6.39.5.19 Attach a breathing bag to swivel bag mount connector.

	6.39.5.20	Set the oxygen flow to 10 l/min. to flush the system of residual gases.
	6.39.5.21	Reduce the oxygen flow to 4.0 l/min.
	6.39.5.22	Slowly adjust the left mounted vaporizer (if fitted) to 1.0% volume concentration, and wait five minutes for the vaporizer to stabilize.
(✓)	6.39.5.23	If applicable, apply the conversion factor to the current value shown on the Riken gas analyzer. Record the reading obtained , the value observed on the multigas analyzer, and the S/N of the vaporizer.
	6.39.5.24	Verify that the displayed "Agent %" value is within the sum of the tolerances of the vaporizer and the Riken gas indicator.
	6.39.5.25	Slowly adjust the vaporizer to 2.5% volume concentration, and wait five minutes for the vaporizer to stabilize.
(✓)	6.39.5.26	Repeat Steps 6.39.5.23 and 6.39.5.24.
	6.39.5.27	Slowly adjust the vaporizer to 4.0% volume concentration, and wait five minutes for the vaporizer to stabilize.
(✓)	6.39.5.28	Repeat Steps 6.39.5.23 and 6.39.5.24.
	6.39.5.29	Turn the vaporizer OFF.
(✓)	6.39.5.30	Repeat Steps 6.39.5.20 thru 6.39.5.29 for the other two vaporizers if applicable. When comparing displayed values with the Riken gas analyzer readings, apply the conversion factors if applicable to the readings obtained with the Riken gas analyzer.
	NOTE:	If any reading is outside of the Multispec tolerance limits, the Multispec analyzer must be recalibrated in accordance with the procedure given in Section 5, and then Procedure 6.39 must be repeated.

6.40 Accessory Attachments and Visual Inspection

6.40.1 Attach each accessory item to its intended location. Reject any item that cannot be properly attached.

6.40.2 Inspect all surfaces of the instrument. Replace labels, disposable items and damaged parts as necessary.

6.41 Battery Circuit Test

6.41.1 Is the green "ON" LED lighted? __ (Y)

6.41.2 With the system power switch ON, unplug the AC power cord.

6.41.3 Press and hold the BATTERY TEST button.

6.41.4 Is the green "BATTERY TEST" LED lighted as long as the BATTERY TEST button is depressed? __ (Y)

6.41.5 Release the BATTERY TEST button.

6.41.6 Is the yellow "AC PWR FAIL" LED lighted as long as the power cord is unplugged? __ (Y)

6.41.7 Does the "AC PWR FAIL" message appear in the ADVISORY column? __ (Y)

6.41.8 Inspect the power cord and strain relief for damage: bent prongs, frayed ends, etc.

6.41.9 Plug the AC power cord back in. Verify that the "AC PWR FAIL" message disappears from the Advisory column of the alarms CRT.

6.42 Ground Continuity Test

6.42.1 Remove the monitor housing top shelf.

6.42.2 Unplug the machine AC power cord from the outlet and plug it into a safety analyzer. Plug the safety analyzer into a wall outlet.

NOTE: Do not plug the safety analyzer into a line isolation monitor as inaccurate readings may occur.

6.42.3 Set the safety analyzer function switch to the GROUND WIRE RESISTANCE position. Attach the test lead to the SINGLE LEAD connector.

6.42.4 Set the safety analyzer GROUND switch to the NORMAL position. Set the POLARITY switch to the OFF position.

6.42.5 The safety analyzer shall indicate 0.1 ohms or less with its test lead applied to the following points:

- Cylinder yoke
- Monitor housing chassis

6.43 Chassis Leakage Current Test

6.43.1 Connect the AC power cord to a safety analyzer and turn the System Power switch to ON.

NOTE: Do not plug the safety analyzer into a line isolation monitor as inaccurate readings may occur.

6.43.2 Set the safety analyzer to the CHASSIS LEAKAGE CURRENT position.

6.43.3 Attach the safety analyzer test lead to a yoke assembly.

(✓) 6.43.4 Record the total leakage current with the polarity and ground switches set to the following positions:

NOTE:	Ground	Polarity
Cycle machine power	Open	Normal
to STANDBY	Normal	Normal
before changing	Open	Reversed
switch position.	Normal	Reversed

6.43.5 Verify that the leakage current is 75 microamps or less in each of the positions (110 microamps or less for 220/240 volt power supply option).

NOTE: All accessory devices must be unplugged from convenience receptacles to determine the leakage current of the NARKOMED 3.

NOTE: The total leakage current of the work station (NARKOMED 3 and all devices plugged into the NARKOMED 3 shall not exceed 100 microamps.

6.44 Service Data

6.44.1 Access the Service Selection Screen by pressing and holding the CHECKOUT key and the LOG DATA key, and press the hidden key directly to the right of the LOG DATA key.

6.44.2 Select "SERVICE DATA" and press ENTER.

(✓) 6.44.3 Record the Last Service Date, Hours Since Serviced, Total Hours, and firmware version numbers for the following:

CO_2/Agt	Baromed	Sphygmomed
O_2Med	ECC	CCC
Spiromed	O_2 SatMed	Alarms CRT

6.45 Oxygen Flush Test

6.45.1 Turn the SYSTEM POWER switch to STANDBY.

6.45.2 Press and release the O_2FLUSH button.

6.45.3 Does the flow of oxygen stop immediately? __ (Y)

6.45.4 Using a 15 mm male connector and short piece of tubing, connect a test minute volumeter to the common gas outlet.

6.45.5 Press the O_2FLUSH button.

(✓) 6.45.6 What is the oxygen flush flow rate? ___ lpm. (45-65)

6.45.7 Remove the test minute volumeter.

6.45.8 Turn the SYSTEM POWER switch to ON.

6.45.9 Insert the sensor from a calibrated O_2Med into the inspiratory valve dome.

6.45.10 Press the O_2FLUSH button.

(✓) 6.45.11 What is the O_2 concentration? ___ % O_2 (97-100)

6.45.12 Remove and cap the O_2Med sensor; plug the inspiratory valve dome adapter.

6.45.13 Close the oxygen cylinder valve.

6.45.14 Bleed the oxygen circuit by pressing the O_2FLUSH button.

(✓) 6.46 Operator's Manual

Verify the availability/location of the NARKOMED 3 Operator's Manual.

(✓) 6.47 Final Check

6.47.1 Verify that the pipeline hoses are connected to the hospital pipeline.

6.47.2 Verify that the APL valve knob is turned completely counterclockwise, fully open.

6.47.3 Verify that the O_2Med sensor is removed from the valve dome adapter.

6.47.4 Verify that the valve dome is plugged.

6.47.5 Verify that the machine is plugged into a live outlet.

6.47.6 Verify that the Manual/Automatic selector valve is in the MANUAL position.

7.0 SOFTWARE UPDATE PROCEDURE

Software updates to the NARKOMED 3 are supplied as firmware in the form of replaceable EPROMs for the Monitors, CCC assembly, Trend assembly, ECC module, and CRT assemblies. The figures that accompany the procedures in this section show the location of the firmware chip on each assembly and its orientation.

7.1 Monitors Firmware Replacement (Typical)

The firmware chip in each monitor is located on the top circuit board and is designated U3. See Figure 7-1. Access to the chip requires removal of the monitor from the machine, and removal of the monitor top cover.

Parts Required:

Firmware - O_2MED (B)	Ver x.xx 4108865
Firmware - BAROMED (B)	Ver x.xx 4108997
Firmware - SPIROMED (B)	Ver x.xx 4109856
Firmware - SPHYGMOMED (B)	Ver x.xx 4109032
Firmware - SAO_2 (B)	Ver x.xx 4108955
Firmware - MULTISPEC	Ver x.xx 4110254

7.1.1 Set the System Power switch to STANDBY and remove AC power from the machine.

CAUTION: Use ESD protection when servicing any of the assemblies inside the monitor housing.

7.1.2 Disable the three circuit breakers on the primary power supply by pulling out each button with a knife or sharp object.

7.1.3 Remove the monitor as outlined in Section 4.

7.1.4 Remove the four screws holding the top cover on the monitor, and remove the cover.

7.1.5 Carefully remove the firmware chip from the circuit board.

7.1.6 Insert the replacement firmware chip into the socket. Be sure that the chip is oriented as shown in the illustration with its notch toward the front of the monitor.

7.1.7 Reinstall the monitor cover, and reinstall the monitor in the machine.

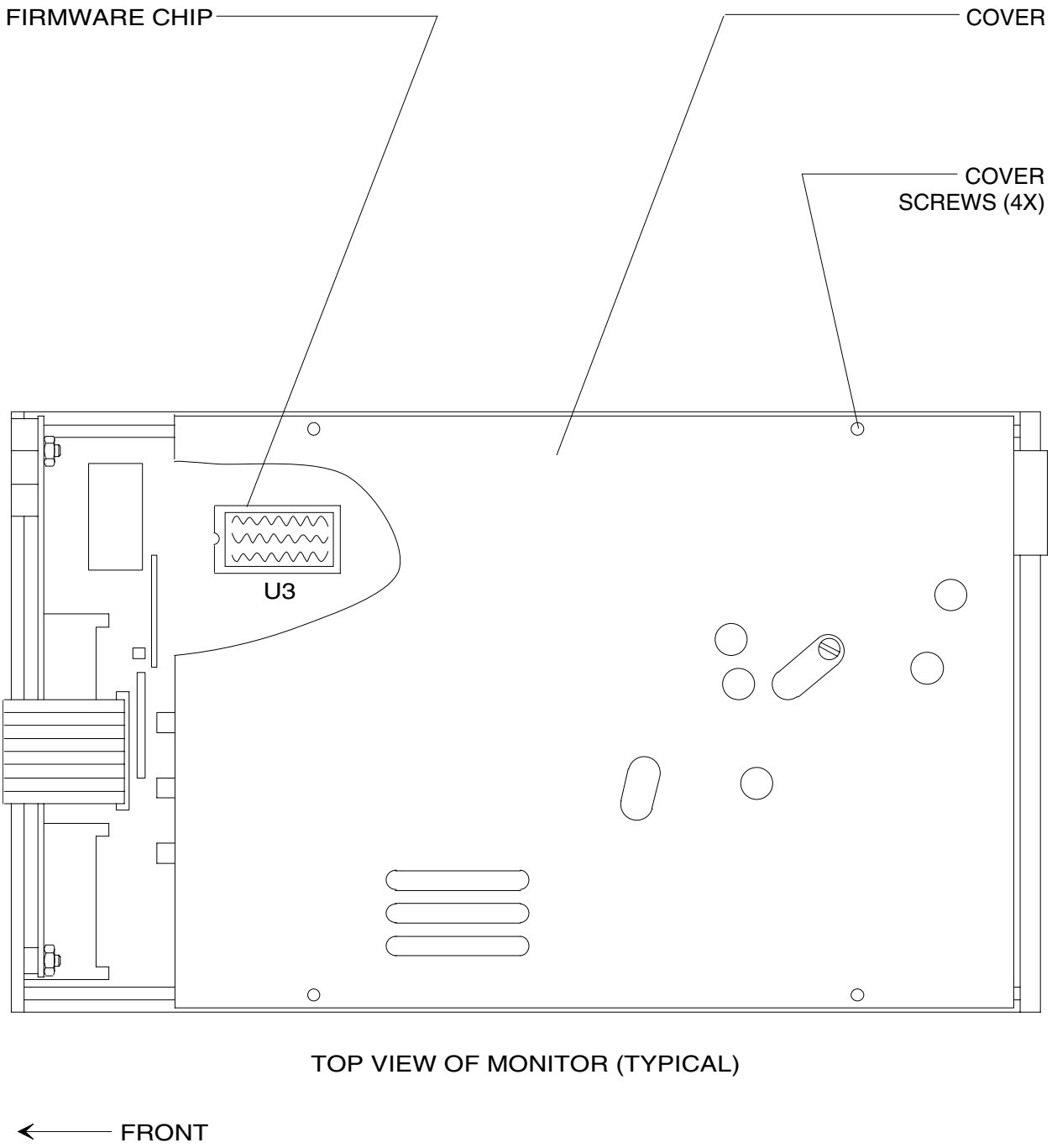
7.1.8 Reset the circuit breakers on the primary power supply.

7.1.9 Restore power to the machine and turn the System Power Switch to ON.

7.1.10 Access the Service Data Screen (Ref. Section 2.3) and observe the software version number that appears on the screen. Verify that it matches the label on the replacement firmware chip.

7.1.11 Turn the System Power switch to STANDBY.

7.1.12 Perform the PMS Procedure given in Section 6.



SV30071

Figure 7-1: FIRMWARE LOCATION - NM3 MONITORS

7.2 CCC Assembly Firmware Replacement

The firmware chip on the CCC assembly is located on the main circuit board assembly and is designated U3. See Figure 7-2. Access to the chip requires removal of the CCC assembly from the machine, and removal of the cover plate from the assembly.

Parts Required: Firmware - CCC Ver x.xx 4108808

7.2.1 Set the System Power switch to STANDBY and remove AC power from the machine.

CAUTION: Use ESD protection when servicing any of the assemblies inside the monitor housing.

7.2.2 Disable the three circuit breakers on the primary power supply by pulling out each button with a knife or sharp object.

7.2.3 Remove the CCC assembly from the monitor housing as outlined in Section 4.

7.2.4 Remove the three screws holding the cover plate to the assembly, and remove the cover plate.

7.2.5 Carefully remove the firmware chip from the circuit board.

7.2.6 Insert the replacement firmware chip into the socket. Be sure that the chip is oriented as shown in the illustration with its notch toward the front of the assembly.

7.2.7 Reinstall the cover plate on the assembly, and reinstall the CCC assembly in the machine.

7.2.8 Reset the circuit breakers on the primary power supply.

7.2.9 Restore power to the machine and turn the System Power Switch to ON.

7.2.10 Access the Service Data Screen (Ref. Section 2.3) and observe the software version number that appears on the screen. Verify that it matches the label on the replacement firmware chip.

7.2.11 Turn the System Power switch to STANDBY.

7.2.12 Perform the PMS Procedure given in Section 6.

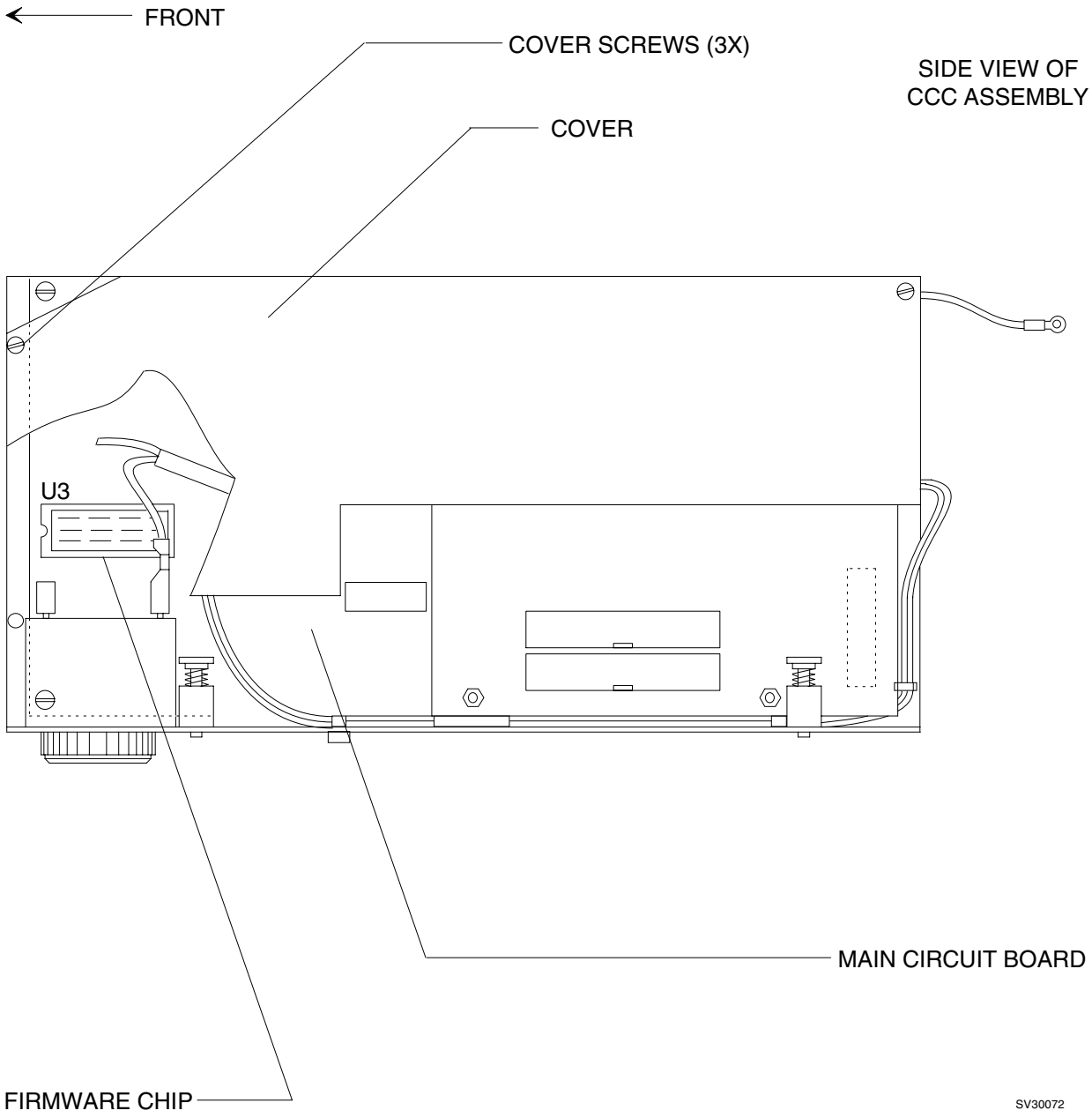


Figure 7-2: FIRMWARE LOCATION - CCC ASSEMBLY

7.3 Trend Assembly Firmware Replacement

The firmware chip on the Trend assembly is located on the CRT Controller circuit board and is designated U20. See Figure 7-3. Access to the chip requires removal of the Trend assembly from the machine.

Parts Required: Trend Mon CRT Ver x.xx 4108436

7.3.1 Set the System Power switch to STANDBY and remove AC power from the machine.

CAUTION: Use ESD protection when servicing any of the assemblies inside the monitor housing.

7.3.2 Disable the three circuit breakers on the primary power supply by pulling out each button with a knife or sharp object.

7.3.3 Remove the Trend assembly from the monitor housing as outlined in Section 4.

7.3.4 Carefully remove the firmware chip from the circuit board.

7.3.5 Insert the replacement firmware chip into the socket. Be sure that the chip is oriented as shown in the illustration with its notch toward the front of the assembly.

7.3.6 Reinstall the Trend assembly in the monitor housing.

7.3.7 Reset the circuit breakers on the primary power supply.

7.3.8 Restore power to the machine and turn the System Power Switch to ON.

7.3.9 Verify that all CRT functions are working correctly.

7.3.10 Turn the System Power switch to STANDBY.

7.3.11 Perform the PMS Procedure given in Section 6.

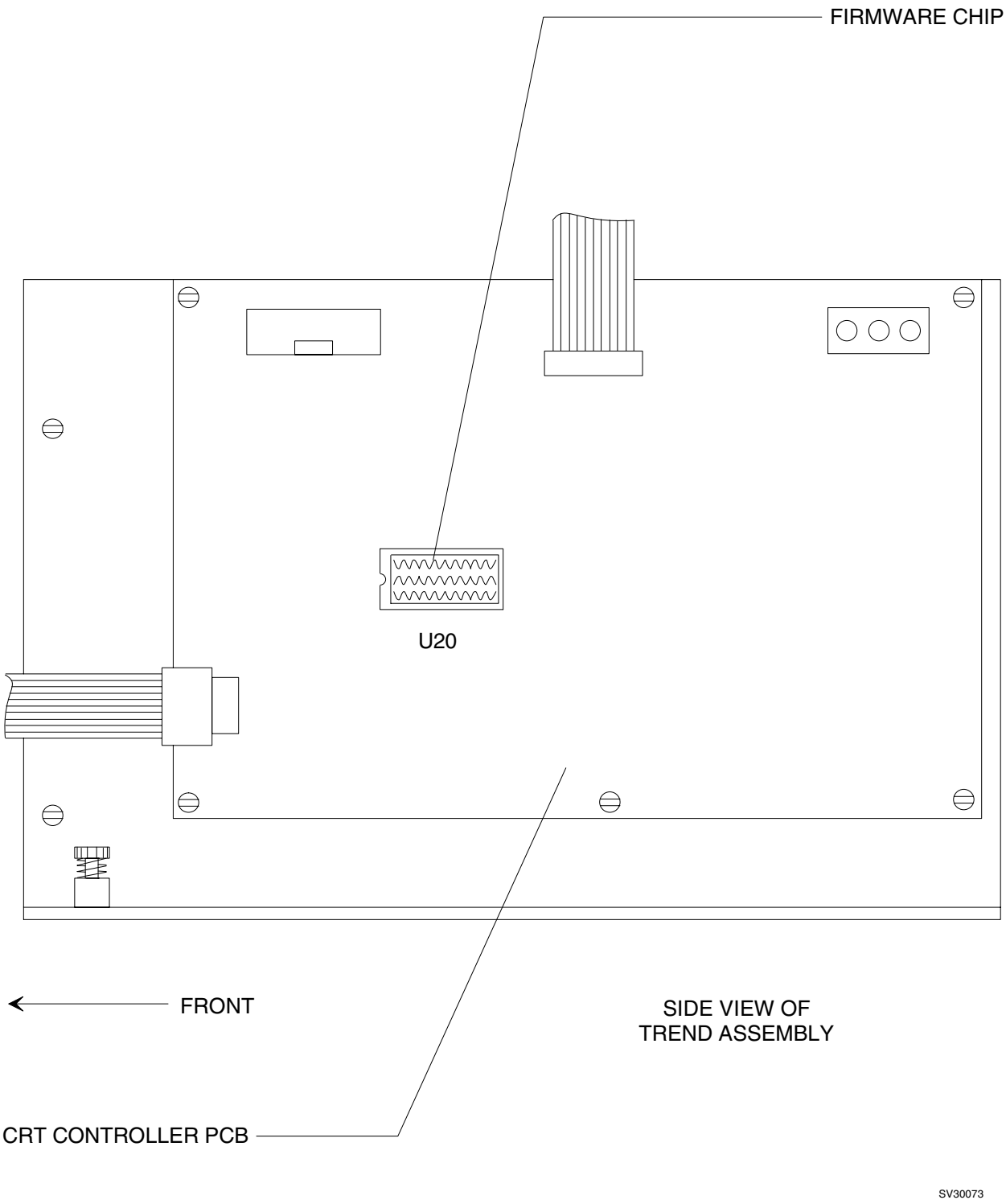


Figure 7-3: FIRMWARE LOCATION - TREND ASSEMBLY

7.4 ECC (Serial Interface) Module Firmware Replacement

The firmware chip in the ECC module is located on the lower circuit board and is designated U2. See Figure 7-3. Access to the chip requires removal of the ECC module from the monitor housing, and removal of the module cover plate.

Parts Required: Firmware - Serial IF Ver x.xx 4109620

7.4.1 Set the System Power switch to STANDBY and remove AC power from the machine.

CAUTION: Use ESD protection when servicing any of the assemblies inside the monitor housing.

7.4.2 Disable the three circuit breakers on the primary power supply by pulling out each button with a knife or sharp object.

7.4.3 Disconnect any cables connected to the serial interface ports on the back of the machine. Open the back cover of the monitor housing and remove the ECC module as outlined in Section 4.

7.4.4 Remove the four screws holding the cover plate to the module, and remove the cover plate.

7.4.5 Carefully remove the firmware chip from the circuit board.

7.4.6 Insert the replacement firmware chip into the socket. Be sure that the chip is oriented as shown in the illustration.

7.4.7 Reinstall the cover plate, and reinstall the ECC module in the back cover of the monitor housing.

7.4.8 Reset the circuit breakers on the primary power supply.

7.4.9 Restore power to the machine and turn the System Power Switch to ON.

7.4.10 Access the Service Data Screen (Ref. Section 2.3) and observe the software version number that appears on the screen. Verify that it matches the label on the replacement firmware chip.

7.4.11 Turn the System Power switch to STANDBY.

7.4.12 Perform the PMS Procedure given in Section 6.

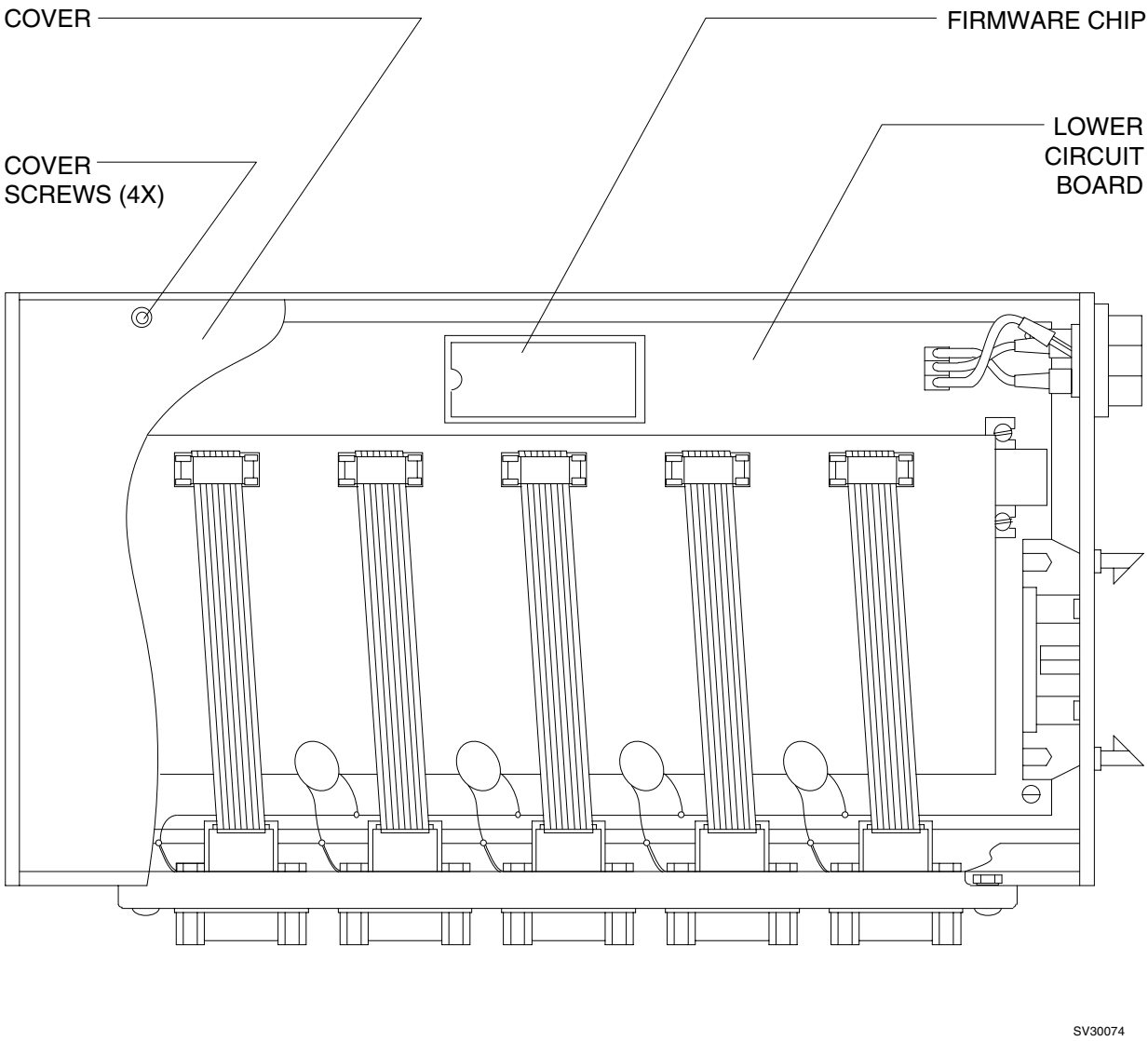


Figure 7-4: FIRMWARE LOCATION - ECC MODULE

7.5 CRT Assembly (Typical) Firmware Replacement

The firmware chip in each CRT assembly is located on the CRT Controller circuit board and is designated U20. See Figure 7-5. Access to the chip requires removal of the CRT assembly from the monitor housing.

Parts Required:	Firmware - Alarms	Ver x.xx 4109323 (Alarm CRT)
	Firmware - NM3 CRT	Ver x.xx 4109324 (Data CRT)

7.5.1 Set the System Power switch to STANDBY and remove AC power from the machine.

CAUTION: Use ESD protection when servicing any of the assemblies inside the monitor housing.

7.5.2 Disable the three circuit breakers on the primary power supply by pulling out each button with a knife or sharp object.

7.5.3 Remove the CRT assembly from the monitor housing as outlined in Section 4.

7.5.4 Carefully remove the firmware chip from the circuit board.

7.5.5 Insert the replacement firmware chip into the socket. Be sure that the chip is oriented as shown in the illustration with its notch toward the front of the CRT assembly.

7.5.6 Reinstall the CRT assembly in the monitor housing.

7.5.7 Reset the circuit breakers on the primary power supply.

7.5.8 Restore power to the machine and turn the System Power Switch to ON.

7.5.9 Verify that all CRT functions are working correctly. For the Alarm CRT, access the Service Data Screen (Ref. Section 2.3) and observe the software version number that appears on the screen. Verify that it matches the label on the replacement firmware chip.

7.5.10 Turn the System Power switch to STANDBY.

7.5.11 Perform the PMS Procedure given in Section 6.

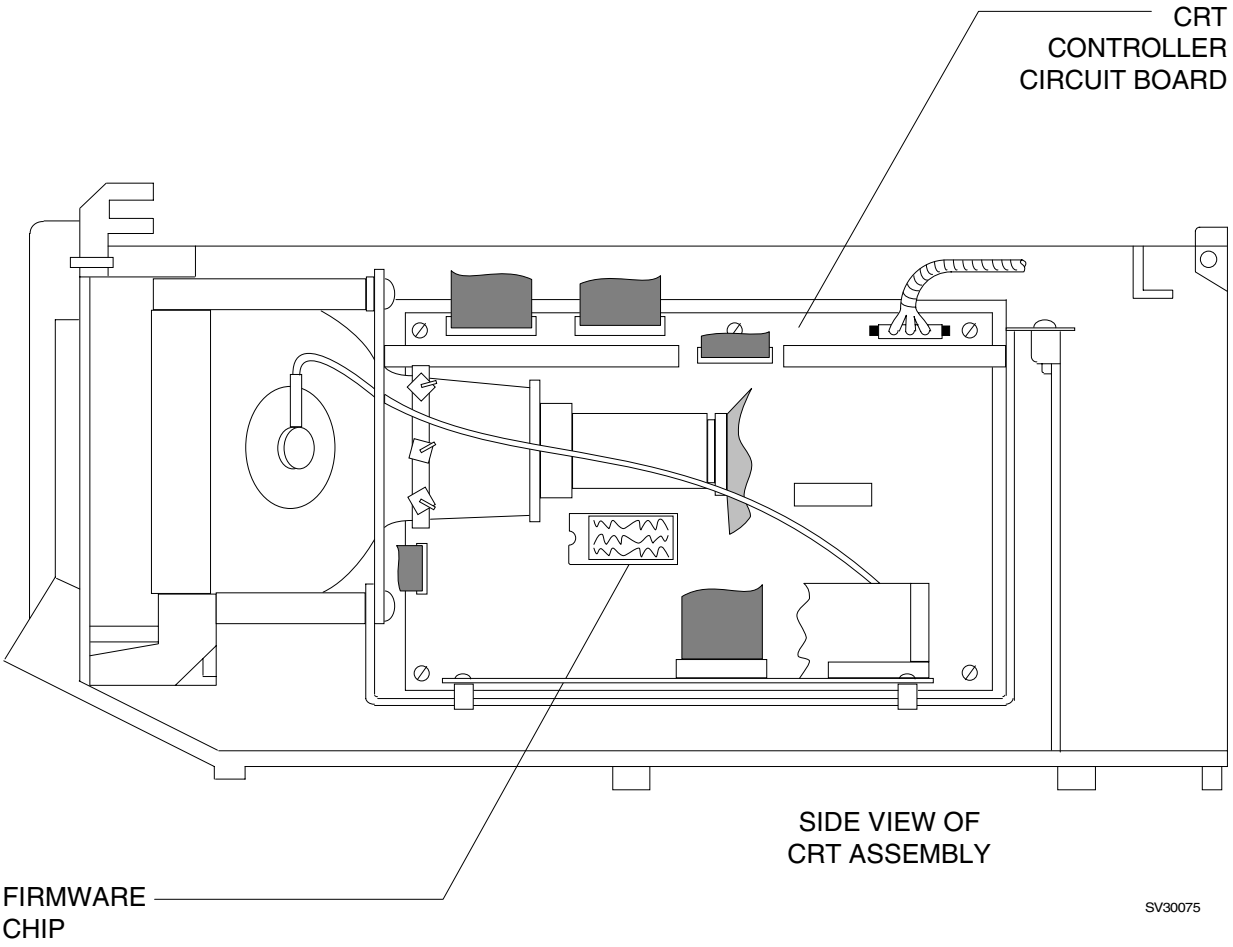


Figure 7-5: FIRMWARE LOCATION - CRT ASSEMBLIES

7.6 Gas Analyzer Interface PCB (Andros 4610) Firmware Replacement

The firmware chip for the Andros 4610 is located on the GAI board on the analyzer PCB assembly. See Figure 7-6. Access to this assembly requires opening the back cover of the monitor housing.

Parts Required: Firmware Ver x.xx 4112595-001

7.6.1 Set the System Power switch to STANDBY and remove AC power from the machine.

CAUTION: Use ESD protection when servicing any of the assemblies inside the monitor housing.

7.6.2 Disable the three circuit breakers on the primary power supply by pulling out each button with a knife or sharp object.

7.6.3 Disconnect any cables connected to the serial interface ports on the back of the machine, and open the back cover of the monitor housing.

7.6.4 Locate the firmware chip on the GAI board and carefully remove the chip.

7.6.5 Insert the replacement firmware chip into the socket. Be sure that the chip is oriented as shown in the illustration.

7.6.6 Close the back cover of the monitor housing and re-attach any interface cables that were previously removed.

7.6.7 Reset the circuit breakers on the primary power supply.

7.6.8 Restore power to the machine and turn the System Power Switch to ON.

7.6.9 Perform the Multispec Flow Rate adjustment given in Section 5.

7.6.10 Turn the System Power switch to STANDBY.

7.6.11 Perform the PMS Procedure given in Section 6.

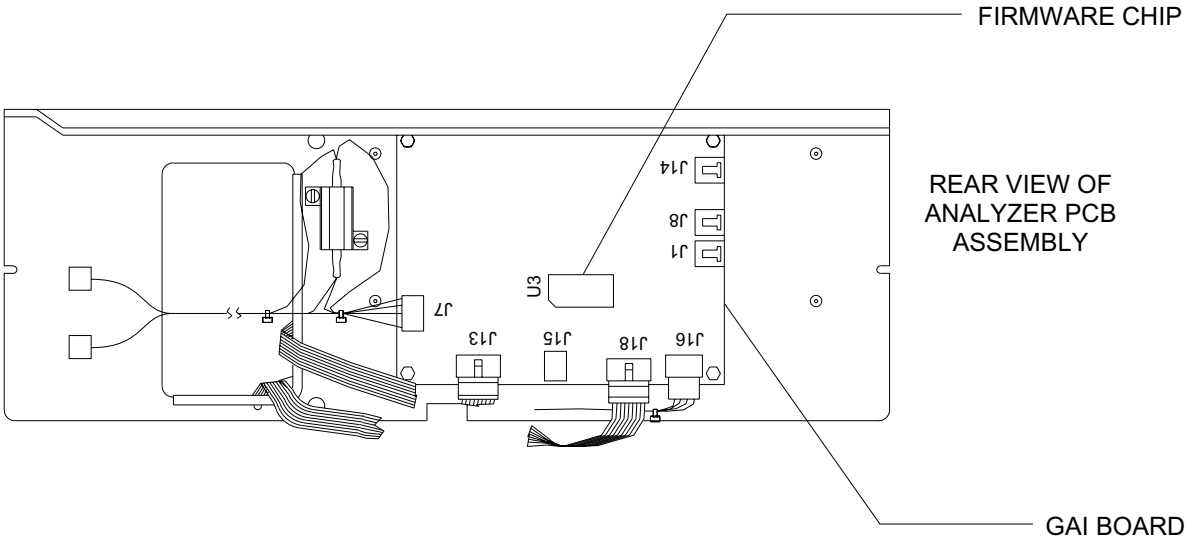


Figure 7-6: FIRMWARE LOCATION - ANDROS 4610 GAI BOARD

RETURN TO THIS MANUAL'S TABLE OF CONTENTS
RETURN TO CD-ROM TABLE OF CONTENTS

8.0 Spare and Replacement Parts

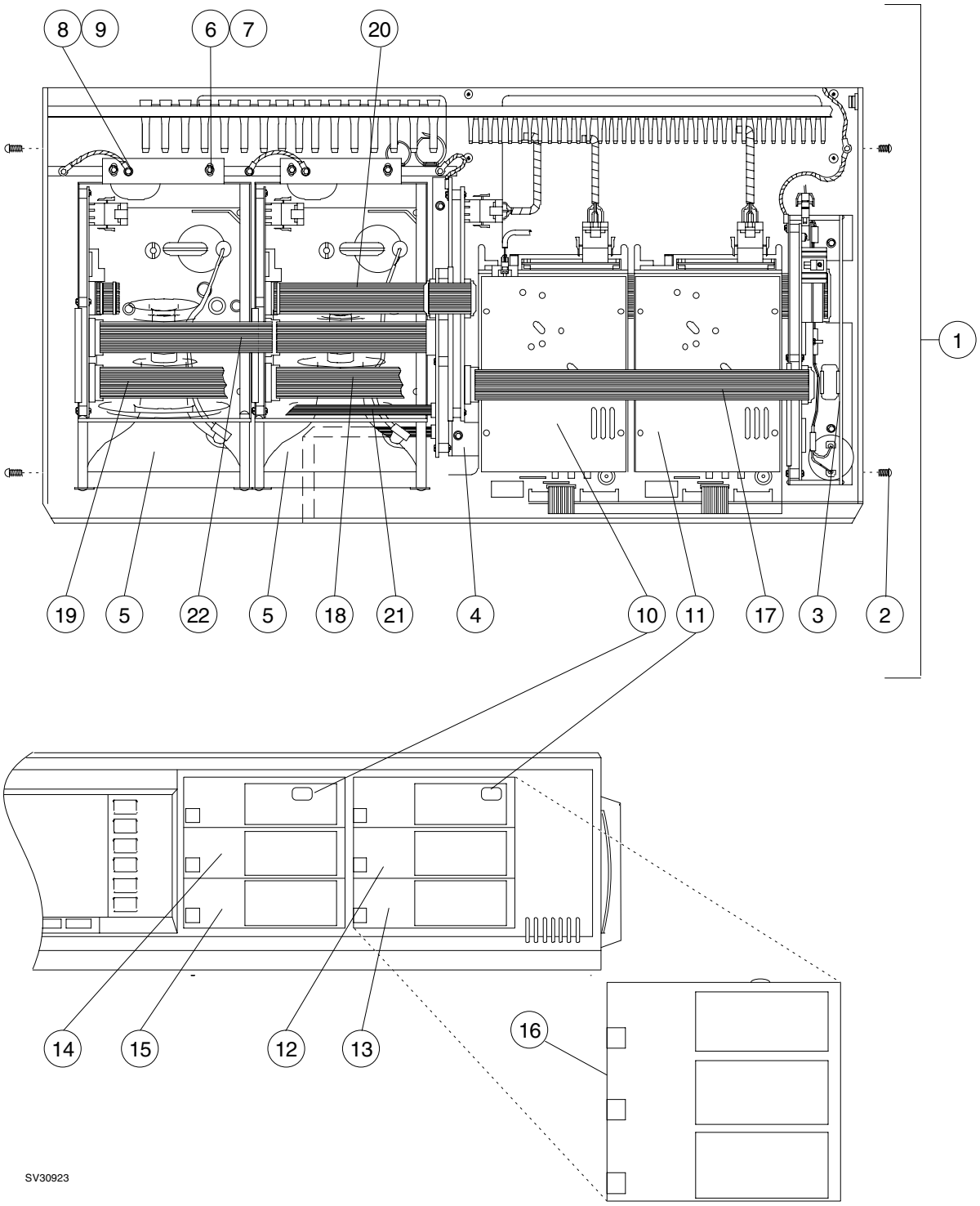
Part numbers for field-replaceable items on the NARKOMED 3 anesthesia system are listed on the following pages, along with part numbers for related hardware and cables.

The item numbers are keyed to the accompanying illustrations to aid in identifying the item and its location.

ASSEMBLY/PART PAGE

Monitor Chassis, Monitors, CCC, Trend/MUX, CRT Assemblies 8-2, 8-3
Front Bezel Assembly, Serial Interface Assembly 8-4, 8-5
Multispec Analyzer Assembly, incl. PCB Assembly 8-6, 8-7
Sphygmomed Module, Pulse Oximeter Module 8-8, 8-9
Ventilator Box Assembly 8-10, 8-11
Ventilator Bellows Valve & Guide Assembly 8-12, 8-13
Pipeline Inlet, Failsafe, Alarm Channel Assemblies 8-14, 8-15
ORMC, Vaporizer Select Switches 8-16, 8-17
Flow Tubes, Gauges, Flow Control Valves, Alarm Channel Items 8-18, 8-19
Yoke, Regulator, Flush Valve Assemblies 8-20, 8-21
Interface Panels, Power Supply Assemblies, Casters 8-22, 8-23
Absorber Assembly, Breathing Pressure Hoses, Oxygen Sensor 8-24, 8-25
Man/Auto Selector Valve 8-26, 8-27
Man/Auto Selector Valve (Later Design) 8-28, 8-29
Auxiliary O_2 Flowmeter Assembly 8-30, 8-31
Open Reservoir Scavenger 8-32, 8-33
Open Reservoir Scavenger, old style 8-34, 8-35
A/C Scavenger 8-36, 8-37
Suction Scavenger 8-38, 8-39

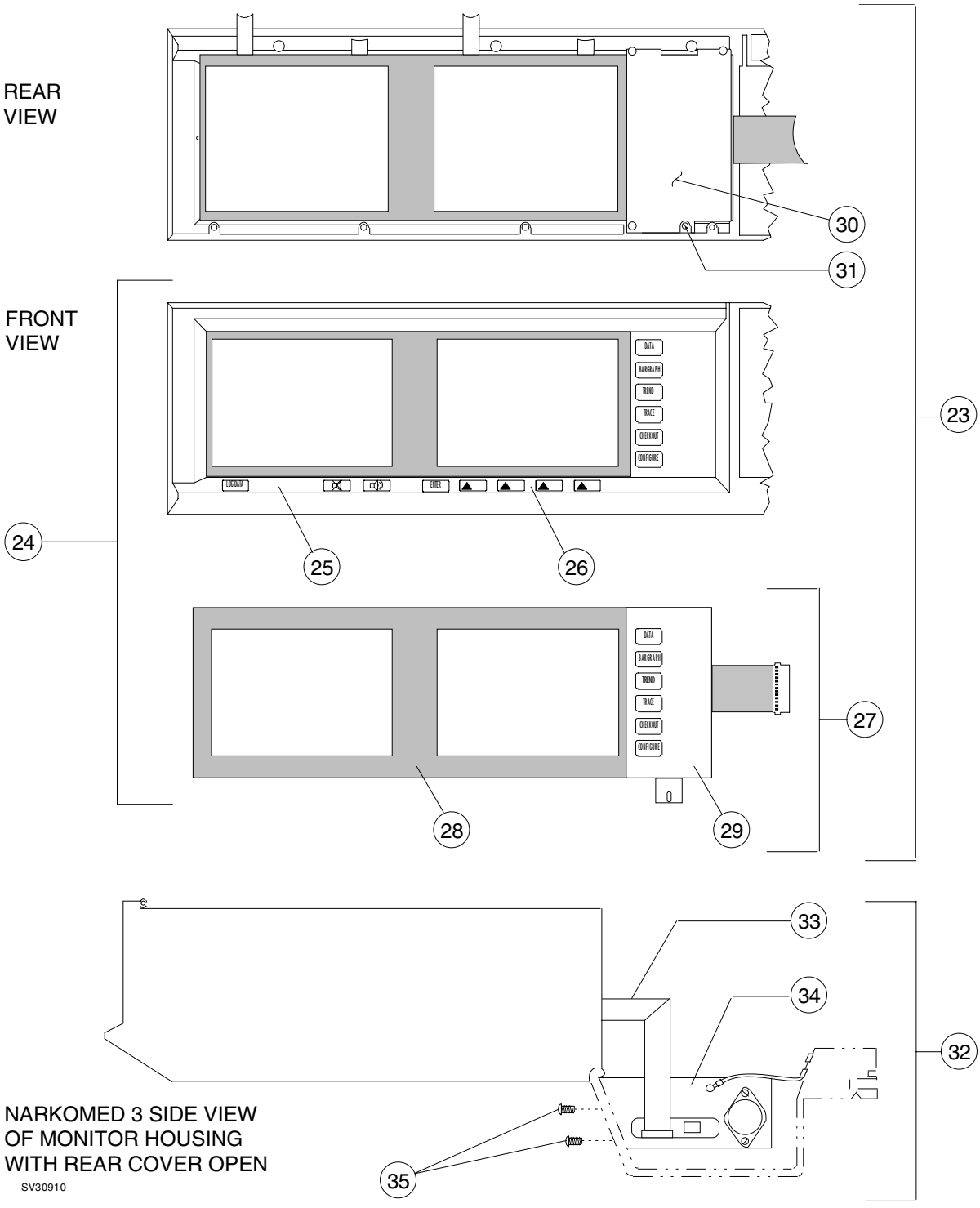
SPARE AND REPLACEMENT PARTS (continued) NM3



ITEM	DESCRIPTION	PART NUMBER
1	CRT/Monitor Housing, Complete	4109055
2	Screw, Top Shelf (4x)	HW04006
3	CCC Assembly	4108769
	Firmware - CCC Ver x.xx	4108808
4	Trend Assembly	4108667
	Firmware - Trend Mon CRT Ver x.xx	4108436
5	CRT Assembly (2x)	4107738
6	Screw, CRT Mounting (2x each CRT)	HW09008
7	Washer, CRT Mounting (2x each CRT)	HW66002
8	Screw, CRT Ground Wire (1x each CRT)	HW02009
9	Washer, CRT Ground Wire (1x each CRT)	HW68000
	Firmware - Alarms Ver x.xx (Alarm CRT)	4109323
	Firmware - NM3 CRT Ver x.xx (Data CRT)	4109324
10	Monitor, O_2MED	4109348
	Firmware - O_2MED (B) Ver x.xx	4108865
11	Monitor, BAROMED	4109349
	Firmware - BAROMED (B) Ver x.xx	4108997
12	Monitor, SPIROMED	4109350
	Firmware - SPIROMED (B) Ver x.xx	4108956
13	Monitor, SPHYGMOMED	4109174
	Firmware - SPHYGMOMED (B) Ver x.xx	4109032
14	Monitor, Pulse Oximeter	4109173
	Firmware - SaO_2 (B) Ver x.xx	4108955
15	Monitor, Multispec*	4110035
	Firmware - Multispec Ver x.xx	4110254
16	Monitor Bezel (2x)	4109047
17	Cable, CCC J3 to Trend/Crt Controller J1	4109253
18	Cable, CCC J4 to Data CRT J1	4109254
19	Cable, CCC J5 to Alarm CRT J1	4109255
	Cable, CCC J2 to Backplane B J4	4109265
	Cable, CCC J3 to Backplane A J4	4109264
20	Cable, Trend/MUX J5 to Data CRT J3	4109258
21	Cable, Trend/MUX J3 to Data CRT J7	4109294
	Cable, Trend/MUX J7 to Data CRT Lower PCB P2	4109257
22	Cable, Trend/MUX J8 to Data CRT J2 and Alarm CRT J2	4109269

*For installations with a 4610 upgrade SE4112924-001

SPARE AND REPLACEMENT PARTS (continued) NM3



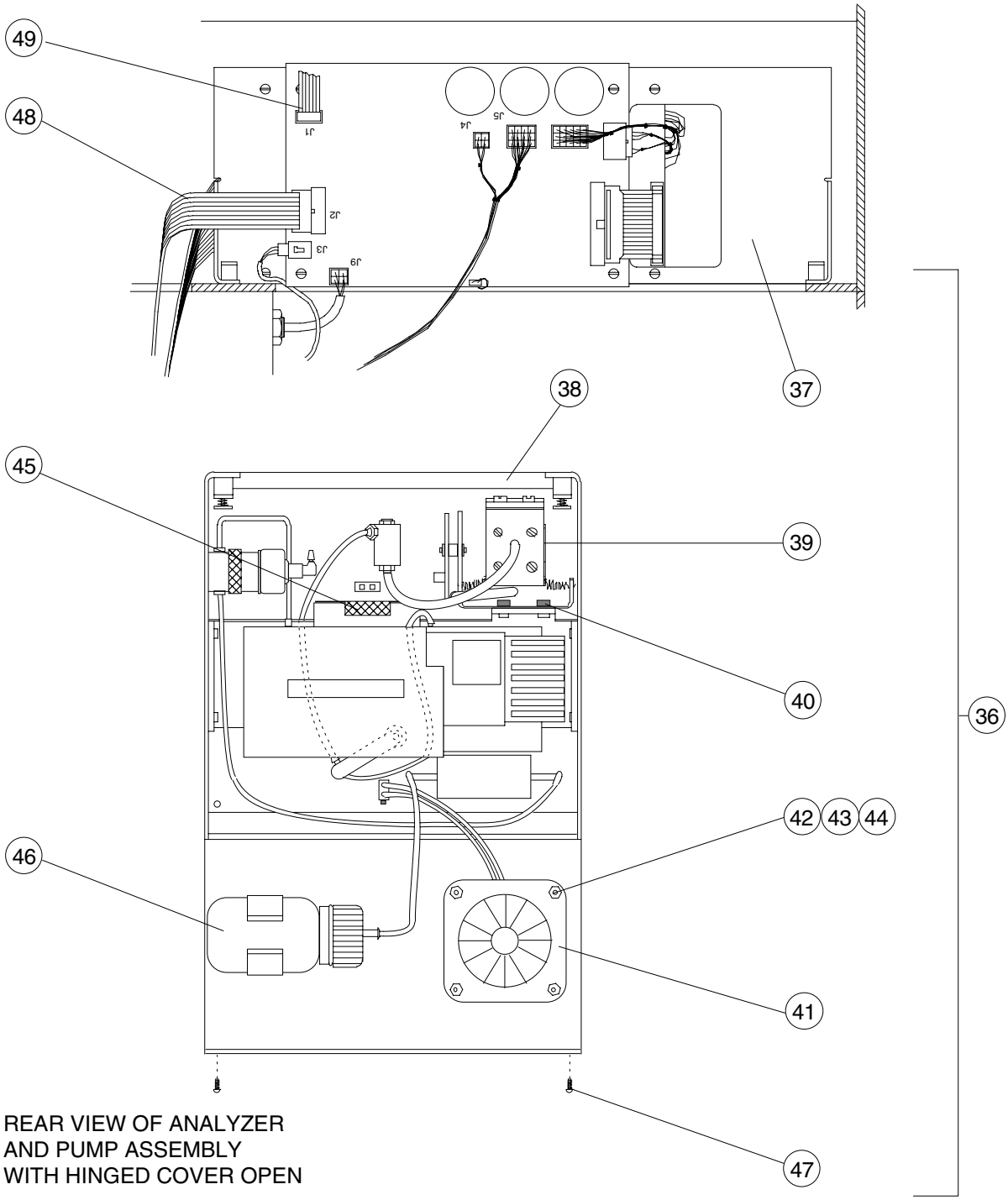
NARKOMED 3 SIDE VIEW
OF MONITOR HOUSING
WITH REAR COVER OPEN

SV30910

ITEM	DESCRIPTION	PART NUMBER
23	Front Bezel Assembly	4109279
24	Switch Panel and Bezel Assembly	4109397
25	Alarm CRT Keypad	4108173
26	Data CRT Keypad	4108174
27	Filter Panel and Switch Assembly	4108864
28	Filter Panel	4108650
29	System Control Keypad	4108523
30	Keypad Retainer Plate	4109061
31	Screw, Retainer Plate (4x)	HW09012
32	Serial Interface Assembly	4108818
33	Data Cable, Serial Interface	4109646
34	Serial Interface Sub-Assembly (ECC Module)	4109623
35	Screw, ECC Module Mounting (4x)	HW09000
	Firmware - Serial IF Ver x.xx	4109620

FRONT (INSIDE) VIEW OF ANALYZER PCB ASSEMBLY

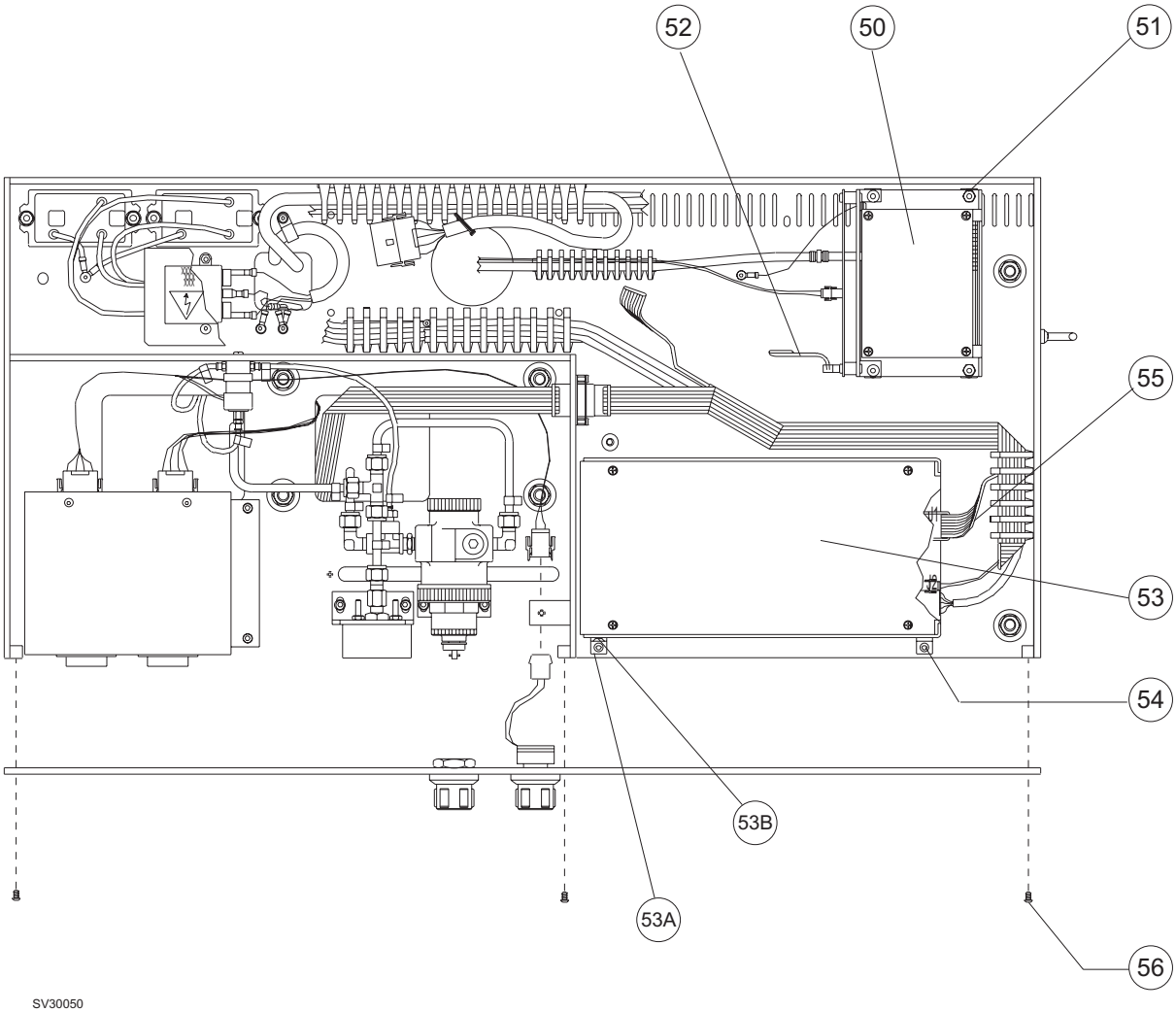
SV30086



REAR VIEW OF ANALYZER
AND PUMP ASSEMBLY
WITH HINGED COVER OPEN

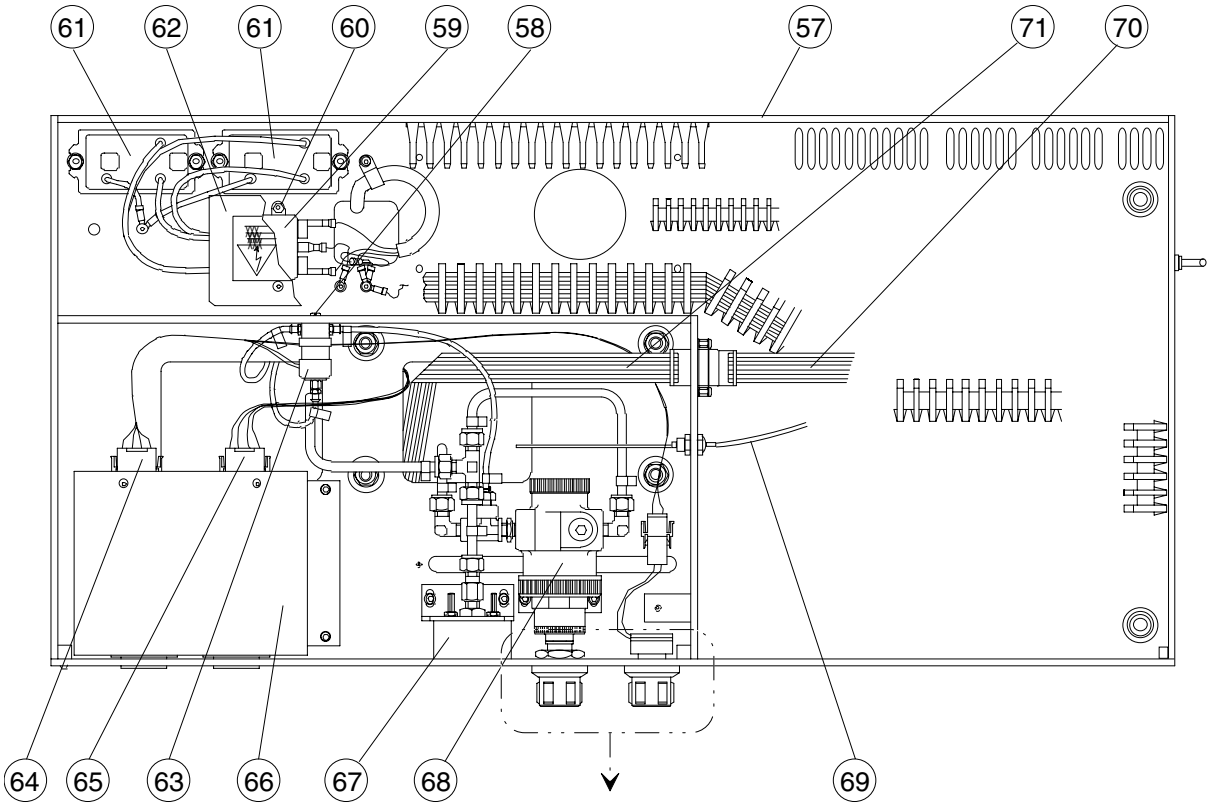
ITEM	DESCRIPTION	PART NUMBER
36	Multispec Analyzer Assembly*	4110442
37	PCB Assembly	4110019
38	Analyzer and Pump Assembly	4109993
39	Pump Assembly	4110894
40	Screw, Pump Assembly Mounting (3x)	HW01001
41	Fan Assembly	4109970
42	Screw, Fan Mounting (4x)	HW09025
43	Lock Washer, Fan Mounting (4x)	HW68001
44	Nut, Fan Mounting (4x)	HW50004
45	Sample Cell	S010000
46	Scrubber Bottle	4110322
47	Screw, Analyzer Cover (2x)	HW09000
48	Cable, Pump Controller J1 to PCB Assembly Servo/Driver J2	4110037
49	Cable, PCB Assembly J1 to Multispec Monitor J1	4109975

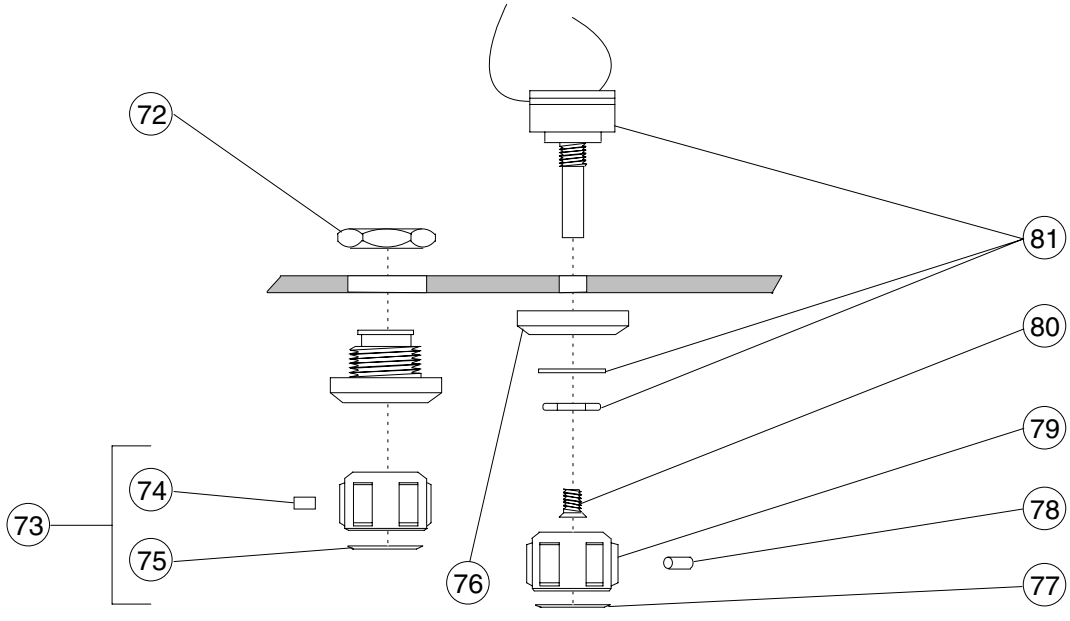
*For installations with a 4610 upgrade SE4112593-001


52
50
51
55
53
54
53B
53A
56
SV30050

ITEM	DESCRIPTION	PART NUMBER
50	Sphygmomed Module	4109797
51	Screw, Sphygmomed Module Mounting (2x)	HW09008
52	Cable, Sphygmomed Module J3 to Sphygmomed Monitor J1	4109038
53	Pulse Oximeter Module, Nellcor	4108860
	Service Exchange part	SE4109134
	Pulse Oximeter Module, Novametrix	4114972
53A	Screw, Pulse Oximeter bracket (4x)	HW03022
53B	Bracket, Pulse Oximeter Mounting (2x)	4109133
54	Screw, Pulse Oximeter Module Mounting (2x)	HW01012
55	Cable, Pulse Oximeter Module J1 to SaO_2 Monitor J1	4109131
56	Screw, Ventilator Box Front Panel (6x)	HW09000

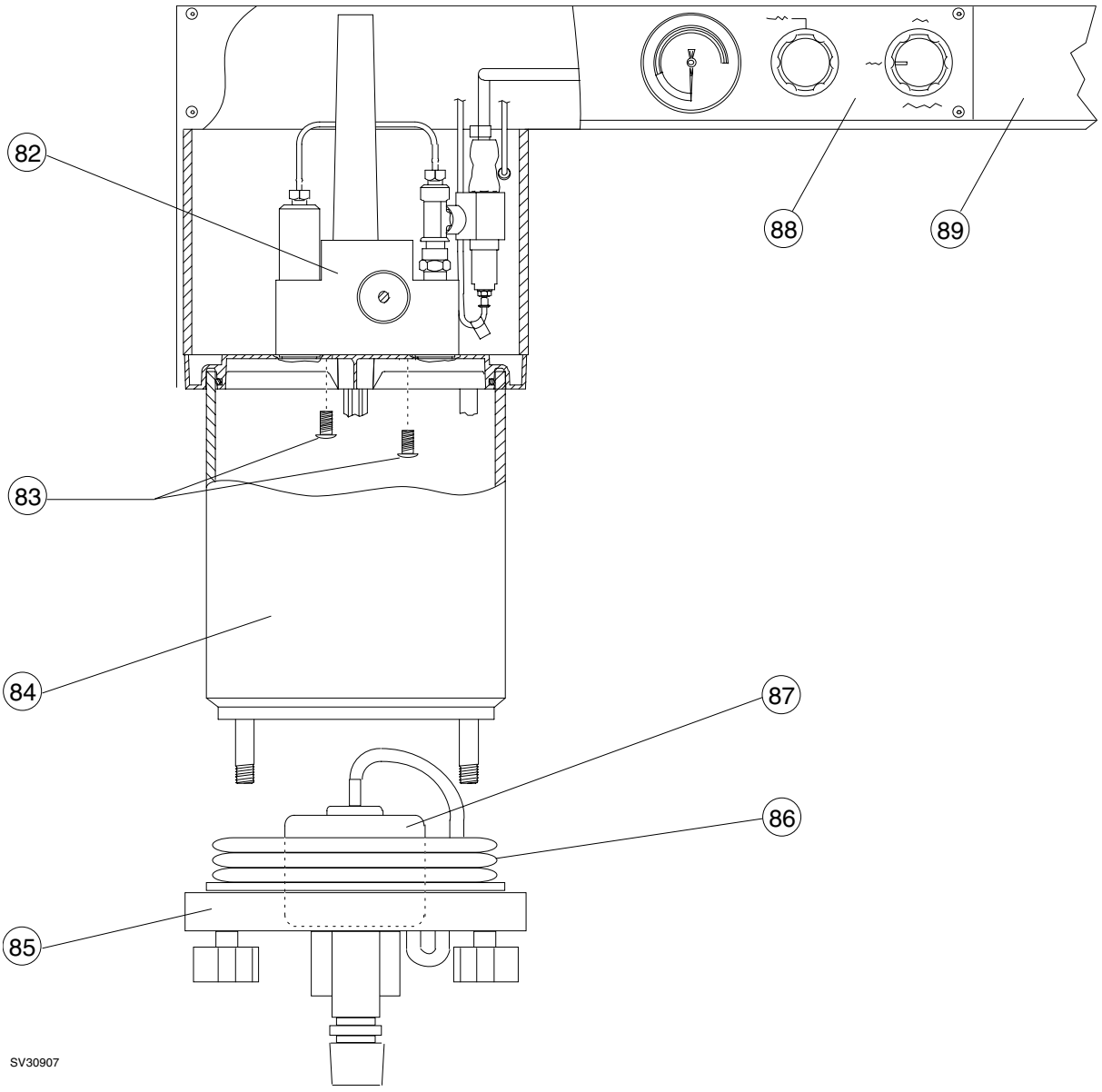
SPARE AND REPLACEMENT PARTS (continued) **NM3**



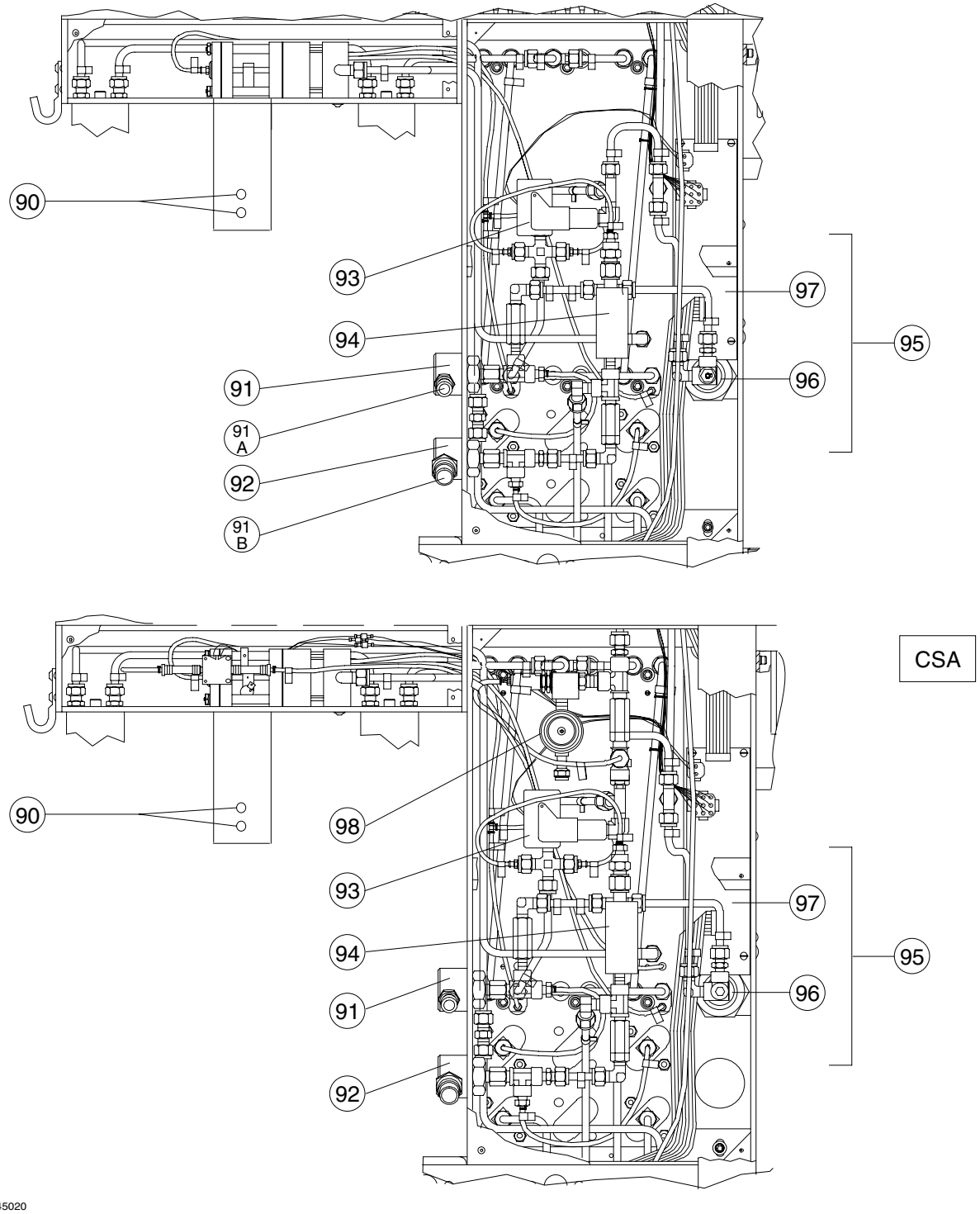


SV20017

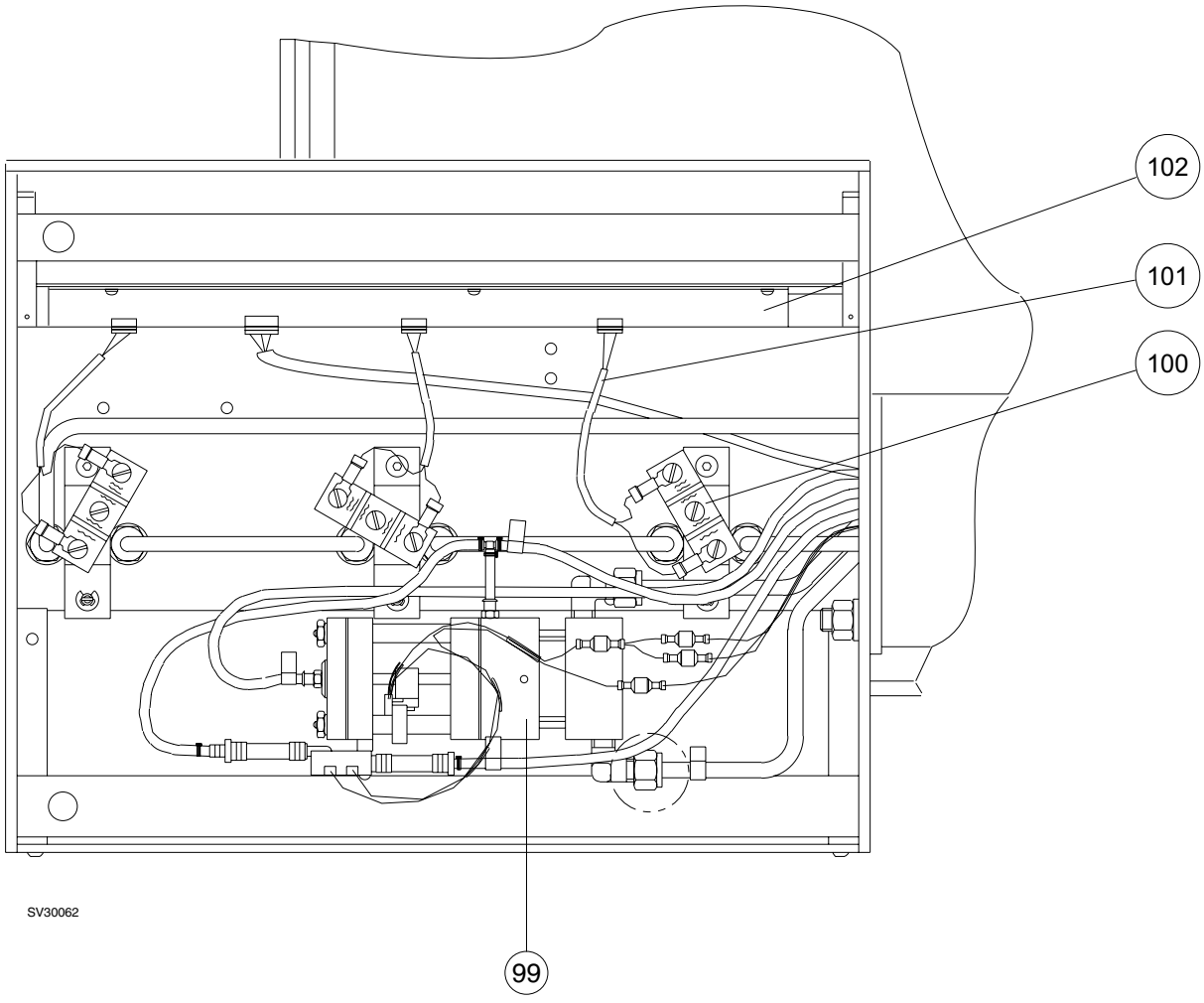
ITEM	DESCRIPTION	PART NUMBER
57	Ventilator Box Assembly	4108918
58	Screw, Ventilator Solenoid Mounting (2x)	HW02011
59	AC Power Filter	4107759
60	Spacer, AC Power Filter Mounting (2x)	4110589-007
61	AC Receptacle (2x)	4106086
62	AC Power Filter Cover	4109622
	Screw, AC Power Filter Cover (2x)	HW09016
63	Ventilator Solenoid	4110906
64	Wire Harness, AVE Switch and Solenoid	4109771
65	Wire Harness, Alarm Channel	4109236
66	Ventilator Controller Assembly	4108948
67	Inspiratory Flow Gauge Assembly	4108856
	New Part Number (Gauge Only)	4111989
68	Inspiratory Flow Regulator Assembly	4108846
69	Cable Assembly, Vapor Lights	4111553
70	Cable Assembly, Ventilator Box to Monitor Box	4109267
71	Cable Assembly, Ventilator Box to Alarm Channel	4109072
72	Nut, Knob Assembly Mounting	4107460
73	Knob Assembly, Incl. Knob, Bezel and Shaft Coupling	4107556
74	Setscrew	HW04007
75	Label	4103396
76	Bezel	4109767
77	Label	4107453
78	Setscrew	HW04007
79	Knob	4103394
80	Screw, Bezel Retainer (2x)	HW03038
81	Switch Assembly	4109768


82
88
89
83
84
87
86
85
SV30907

ITEM	DESCRIPTION	PART NUMBER
82	Ventilator Bellows Valve & Guide Assembly	4110775
83	Screw, Valve & Guide Assembly Mounting (2x)	HW09013
	Bellows Valve Case Assembly (Early Design)	V4108859
	Screw, Valve Case Assembly Mounting (4x)	HW01016
84	Bellows Canister	4106948
85	Bellows Assembly, Adult	4106935
86	Bellows Sub-assembly, Adult	4106930
	Urethane (Non-Latex) Bellows Sub-assembly, Adult	4106930-001
87	Relief Valve Assembly	4108050
	Diaphragm Assembly	4110960
88	Ventilator Box Front Panel, Left	4111420
89	Ventilator Box Front Panel, Right	4111421

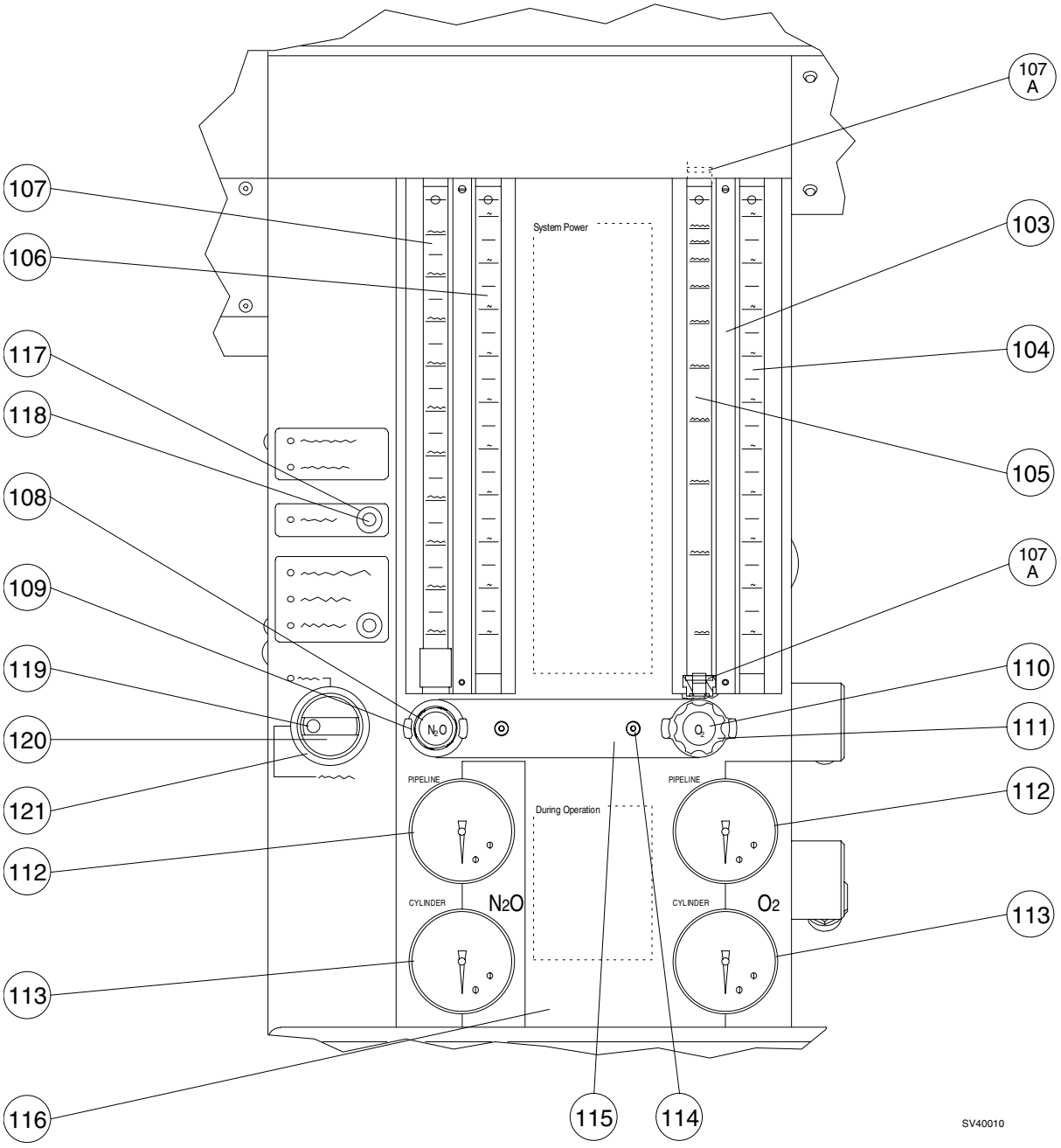

90
93
94
91
91 A
92
91 B
97
95
96
CSA
90
98
93
94
91
92
97
95
96
SV45020

ITEM	DESCRIPTION	PART NUMBER
90	Vaporizer Mounting Screw, 4 x 30 Metric (2x Per Vaporizer)	HW01072
	Vaporizer Gasket, O-Ring (2x Per Vaporizer)	2121929
91	Pipeline Inlet Assembly, O_2	4109345
	Pipeline Inlet Assembly, O_2 (Canada)	4109297
91A	Connector, N.I.S.T., O_2 Male (Export)	4110388
92	Pipeline Inlet Assembly, N_2O	4109344
	Pipeline Inlet Assembly, N_2O (Canada)	4109298
92A	Connector, N.I.S.T., N_2O Male (Export)	4111382
	Pipeline Inlet Assembly, Air	4109412
	Pipeline Inlet Assembly, Air (Canada)	4109861
	Connector, N.I.S.T., Air Male (Export)	4110386
	Filter, Pipeline Inlet (Typ., All Inlets)	4106198
93	Oxygen Supply Pressure Alarm Switch	4106037
94	Oxygen Supply Failure Protection Device, N_2O	4108686
	Oxygen Supply Failure Protection Device, Air	4108687
95	Alarm Channel Assembly (Early models)	4108592
	(Later models)	4111522
96	Main Switch Valve & Fitting Assembly (Early models)	4109285
97	Alarm Circuit Board Assembly (Early models)	4108567
	(Later models)	4111777
	Screw, Circuit Board Mounting (4x)	HW02011
98	Oxygen Supply Low Pressure Alarm Whistle (Canada)	4109946
	Reservoir Assembly, Alarm Whistle (Canada)	4109947


102
101
100
SV30062
99

ITEM	DESCRIPTION	PART NUMBER
99	Oxygen Ratio Monitor/Controller Assembly (Early models)	4109271
	(Later models without electrical conections)	4111765
100	Vaporizer Select Switch (3x)	4103341
101	Wiring Harness,Vaporizer Select Switch (3x)	4110233
102	Circuit Board, Vapor Indicator	4110219

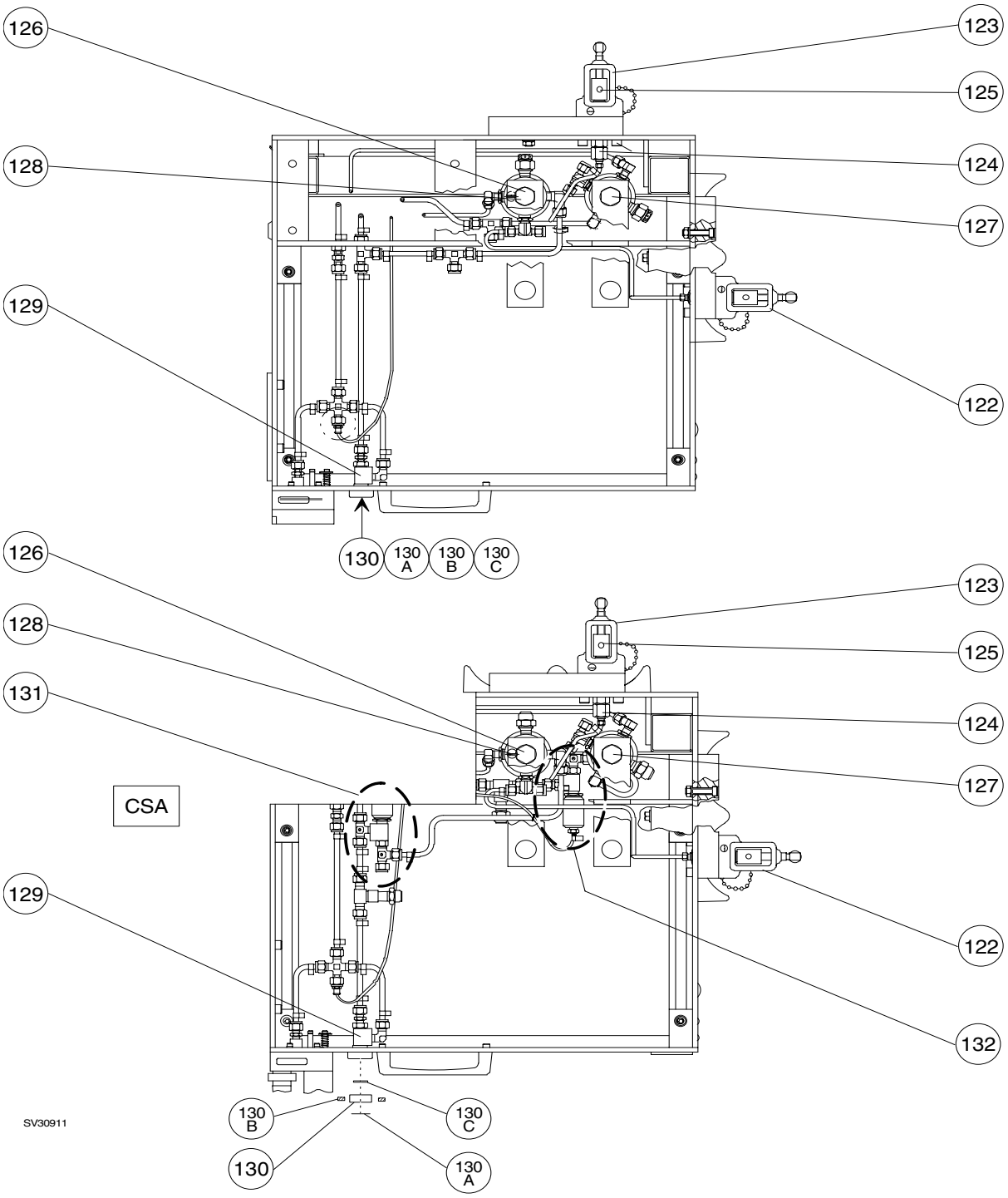
SPARE AND REPLACEMENT PARTS (continued) NM3



ITEM	DESCRIPTION	PART NUMBER
103	Flowmeter Light Circuit Assembly (2x)	4107370
104	Flow Tube, O_2, 1-10 L/min	4103418
105	Flow Tube, O_2, 100-1000 mL/min	4103417
106	Flow Tube, N_2O, 1-10 L/min	4103420
107	Flow Tube, N_2O, 100-1000 mL/min	4103419
	Flow Tube, Air, 1-10 L/min	4106693
	Flow Tube, Air, 100-1000 mL/min	4106692
107A	Gasket, Flow Tube (2x per Tube)	4102724
108	Label, N_2O Flow Control Knob, Blue (USA, UK, Canada)	4103904
	Gray (Germany)	4111266-004
109	Knob, Flow	4103736
110	Label, O_2 Flow Control Knob, Green (USA)	4103178
	White (UK, Canada)	4105981
	Blue (Germany)	4111266-002
111	Knob, O_2	4103156
	Label, Air Flow Control Knob, Yellow (USA, Germany)	4103905
	Black/White (UK, Canada)	4105982
	Label, CO_2 Flow Control Knob, Gray (USA,UK, Canada)	4103908
	Black (Germany)	4111266-006
	Label, O_2-He Flow Control Knob, Green/Brown (USA)	4110951
	White/Brown (Canada)	4110952
	Valve Cartridge, Flow Control	4103352
	New part number	4115871
112	Gauge, 100 psi	4110575-001
113	Gauge, 3000 psi	4110575-002
The following gauge part numbers apply to earlier machine configurations:		
	Gauge, 100 psi O2	4103076
	Gauge, 4000 psi O2	4103074
	Gauge, 100 psi N2O	4103100
	Gaugem 2000 psi N2O	4103075
114	Screw, Knob Guard Mounting (2x)	HW09017
115	Knob Guard, 2-Gas	4110621
	Knob Guard, 3-Gas	4110574
116	Flowmeter Shield, 2 Gas	4110584-001
	Flowmeter Shield, 3 Gas (Air)	4110585-001
	Flowmeter Shield, 2 Gas (Canada)	4110584-002
	Flowmeter Shield, 3 Gas (Air) (Canada)	4110585-002
	Flowmeter Shield, 4 Gas (Export)	4111226
117	*Housing, Push Button	4106046
118	*Cap, Push Button	4106047
119	*Label, Dot	4103423
120	*Knob, Main Switch	4106044
121	*Housing, Main Switch	4106045

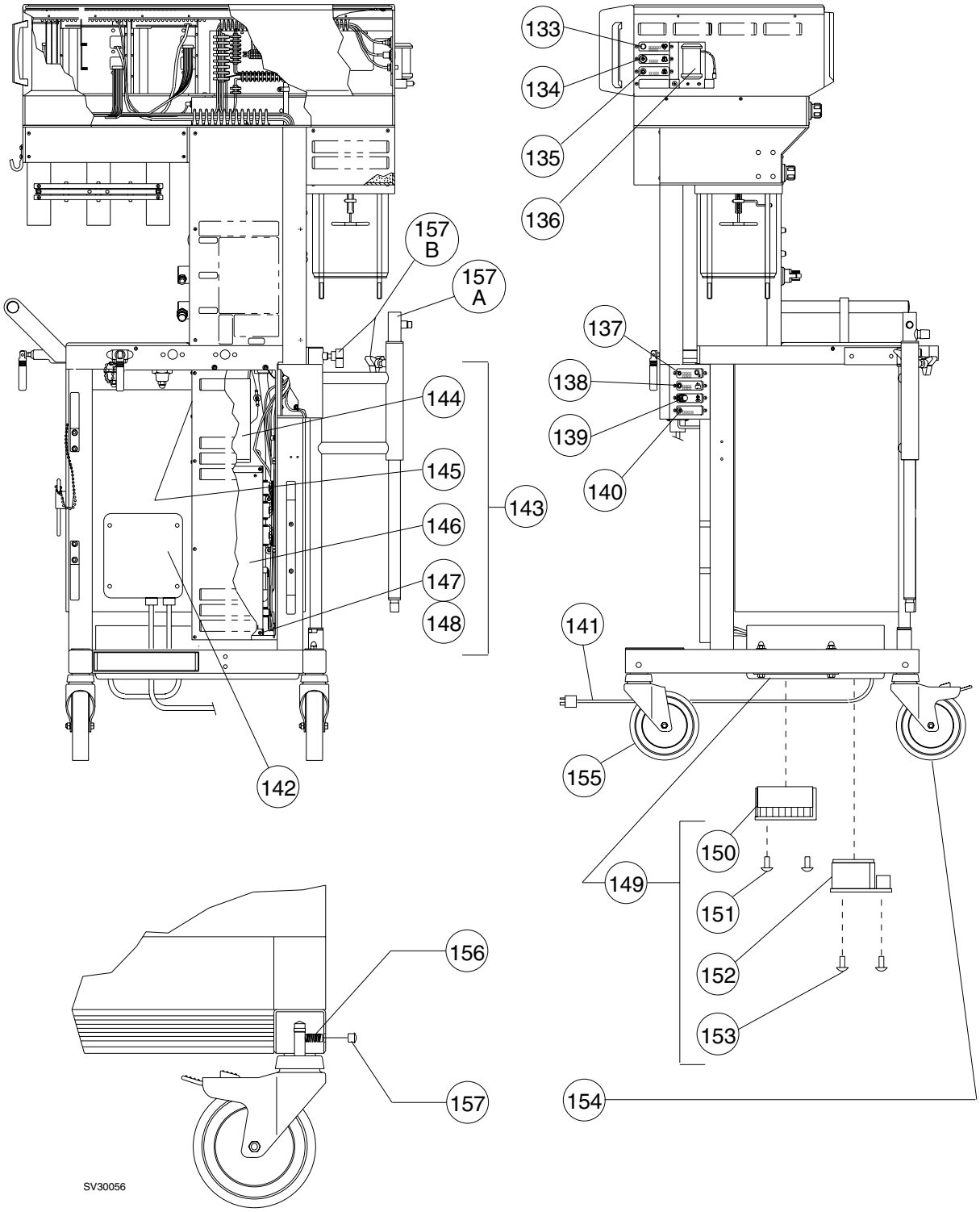
* These items are part of Alarm Channel Assembly 4108592 (Early models)
4111522 (Later Models)

SPARE AND REPLACEMENT PARTS (continued) NM3



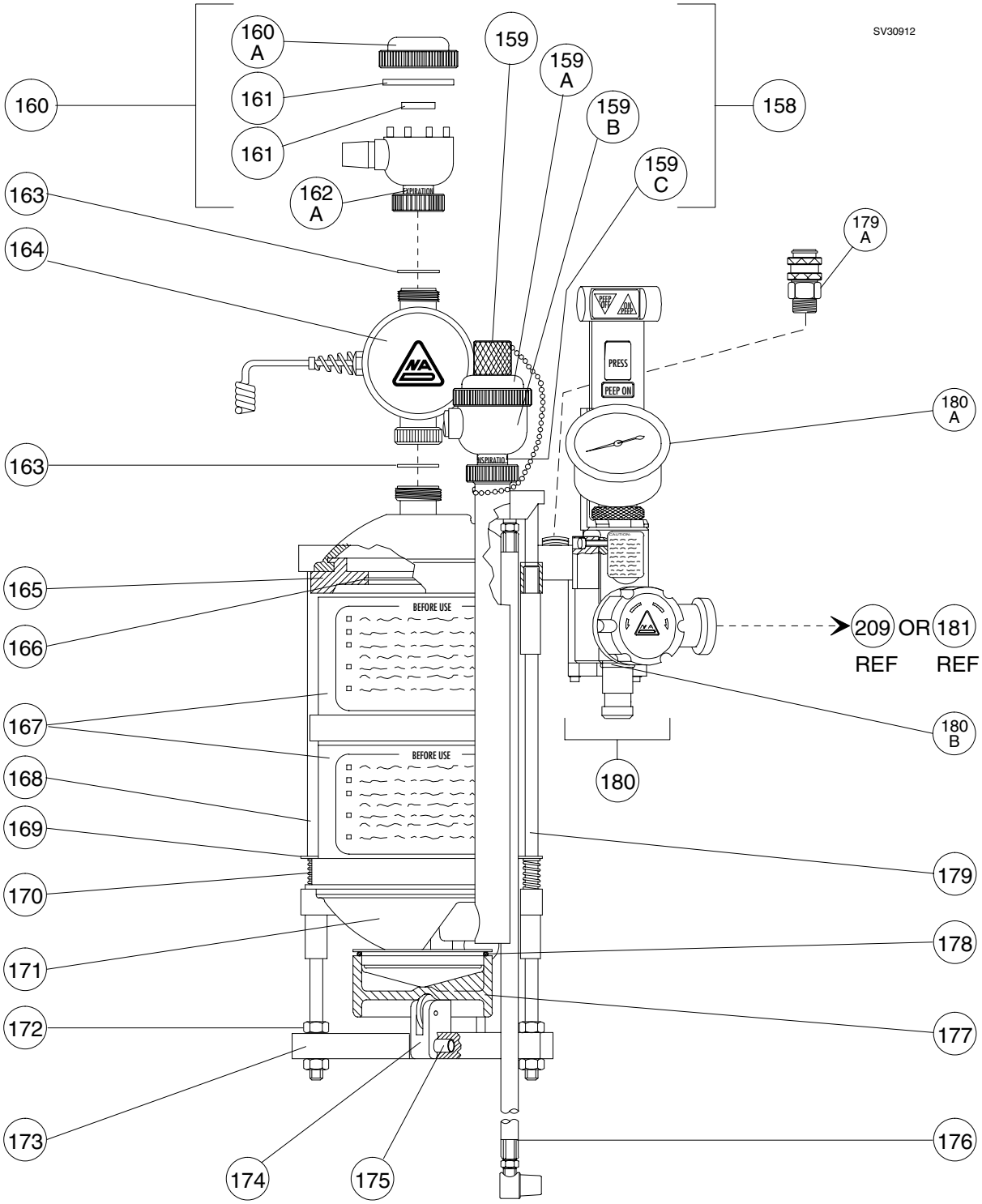
ITEM	DESCRIPTION	PART NUMBER
122	Cylinder Yoke Assembly, O_2	1101640
	Label, O_2, Green (USA)	1101768
	White (UK)	4103890
	Blue (Germany)	4111266-001
	Cylinder Yoke Assembly, O_2 (Canada)	4109943
123	Cylinder Yoke Assembly, N_2O	1101641
	Label, N_2O, Blue (USA, UK, Canada)	1101619
	Gray (Germany)	4111266-003
	Cylinder Yoke Assembly, Air	1101645
	Label, Air, Yellow (USA, Germany)	4102742
	Black/White (UK)	4103826
	Cylinder Yoke Assembly, Air (Canada)	4109944
124	Check Valve Assembly (Typ., All Yokes)	4111792
125	Plug, Yoke (Typ., All Yokes)	1101655
	Chain, Yoke Plug (Typ., All Yokes)	4101868
	Label, CO_2, Gray (USA, UK)	1101639
	Black (Germany)	4111266-005
	Label, O_2-He, Green/Brown (USA)	4110950
	White/Brown (Canada)	4110942
	Screw, Yoke Mounting (2x Per Yoke)	HW01058
	Lockwasher, Yoke Mounting (2x Per Yoke)	HW65005
126	Regulator, O_2 Cylinder Pressure	4103797
127	Regulator, N_2O Cylinder Pressure	4103798
	Regulator, O_2 Cylinder Pressure (Canada)	4110656
	Regulator, N_2O Cylinder Pressure (Canada)	4110655
	Regulator, He/Air/N_2 Cylinder Pressure (Canada)	4110658
	Regulator, CO_2 Cylinder Pressure (Canada)	4110657
128	Setscrew, Regulator Mounting (2x Per Regulator)	HW10001
129	O_2 Flush Valve & Fitting Assembly	4108744
	Restrictor, O_2 Flush Valve	4101867
	Spacer	4110792-006
130	Button, O_2 FLUSH	4103249
130A	Label, ⅝ Dot, O_2, Green (USA)	4103178
	White (UK, Canada)	4105981
	Blue (Germany)	4111266-002
130B	Set Screw, 3-48 x 3/16 (2x)	HW04020
130C	Washer	4110792-021
131	Cylinder Cutoff Valve Assembly, O_2 (Canada)	4110163
132	Cylinder Cutoff Valve Assembly, N_2O (Canada)	4110161
	Cylinder Cutoff Valve Assembly, 3rd Gas (Canada)	4110162

SPARE AND REPLACEMENT PARTS (continued) NM3

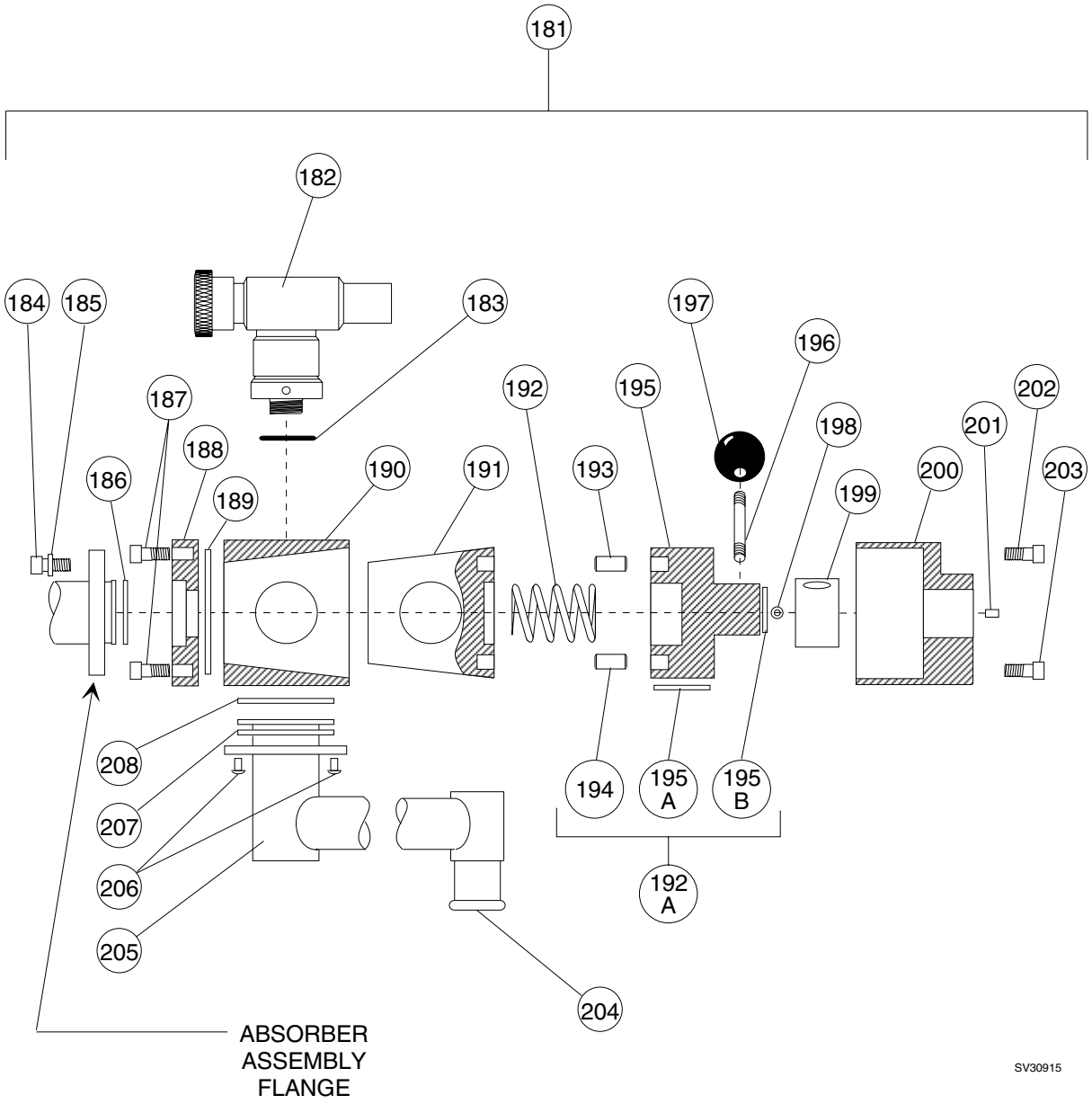


ITEM	DESCRIPTION	PART NUMBER
133	Interface Panel Assembly, Nellcor Pulse Oximeter (Incl. Cable to Module) (Interface Panel Assembly for Novametrix Pulse Oximeter is supplied with P/N 4114972)	4109118
134	Interface Panel Assembly, Sample Line (Incl. Tubing to Analyzer)	4109915
135	Interface Panel Assembly, Sphygmomed (Incl. Tubing to Module)	4109057
136	Reservoir, Auxiliary Water Trap	4110616
137	Interface Panel Assembly, O_2MED (Incl. Cable to Monitor)	4108825
138	Interface Panel Assembly, SPIROMED (Incl. Cable to Monitor)	4108960
139	Interface Panel Assembly, BAROMED (Incl. Tubing to Monitor)	4108996
140	Interface Panel Assembly, Exhaust (Incl. Tubing to Analyzer)	4108147
141	AC Power Cord Assembly (120V)	4109164
142	Power Supply Assembly (Transformer) 220/240V	4111036
143	Power Supply Assembly, Secondary	4109093
144	Multispec Power Supply	4109912
145	Screw, Multispec Power Supply Mounting (3x)	HW09000
146	Power Controller Sub-Assembly	4109092
147	Screw, Power Controller Sub-Assembly Mounting (4x)	HW01014
148	Washer, Power Controller Sub-Assembly Mounting (4x)	HW67000
149	Power Supply Assembly, Primary	4109135
150	Power Supply	4109476
151	Screw, Bottom and Mounting, Power Supply Bracket (8x)	HW09008
	Screw, Power Supply Bracket Side (3x)	HW03005
152	Battery Pack Assembly	4109115
	Service Exchange part number	SE4109115
153	Screw, Battery Pack Mounting (4x)	HW09008
154	Caster W/Brake (2x) (Old Part Nunber: 4109382)	4111849
155	Caster W/O Brake (2x) (Old Part Number: 4109383)	4111850
156	Setscrew, Caster (4x)	HW04017
157	Hole Plug, Setscrew (4x)	4102729
157A	Absorber Pole	1101724
157B	Wing Screw, ⅜-16 x 1 in.	1100078

SPARE AND REPLACEMENT PARTS (continued) NM3



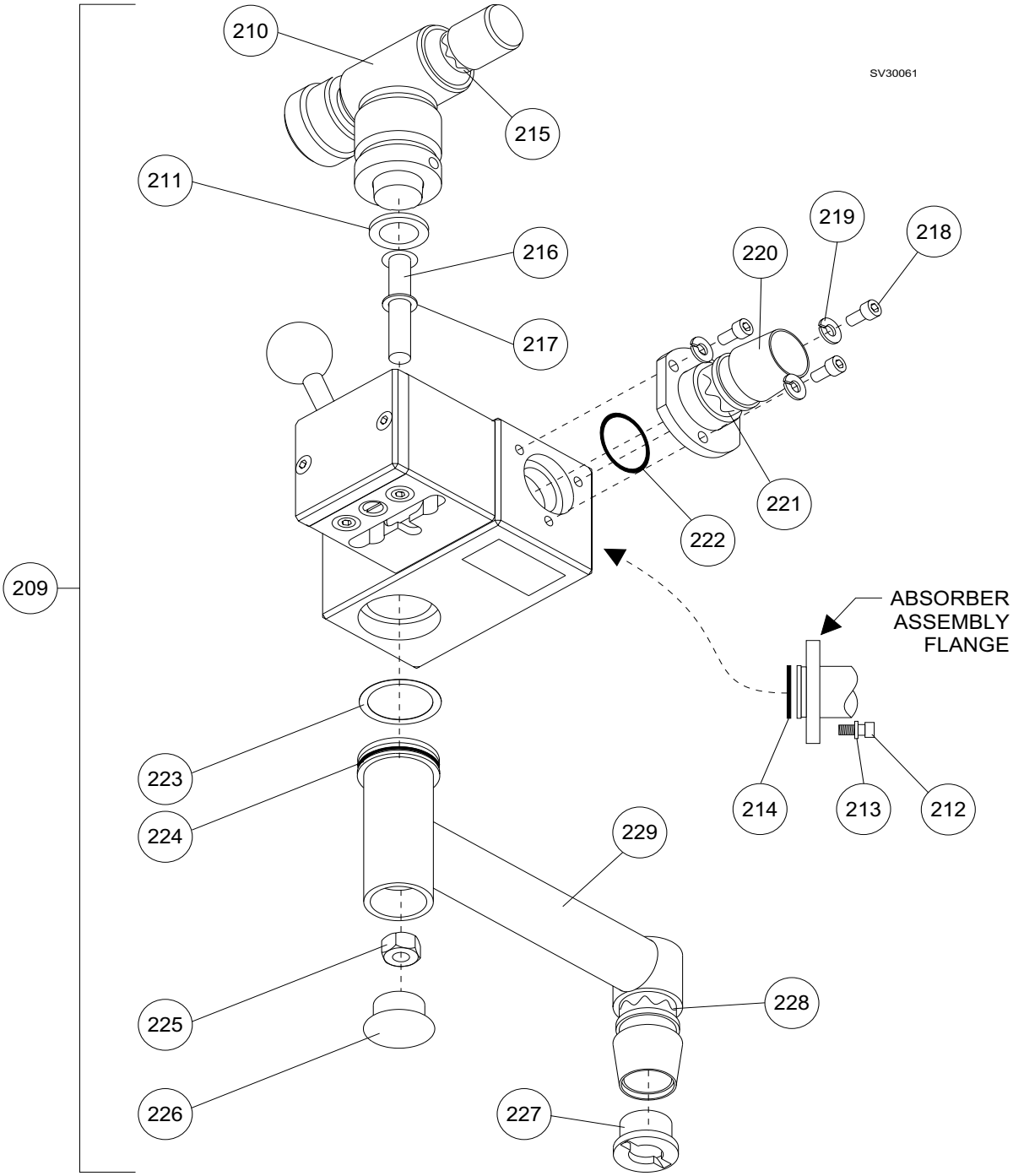
ITEM	DESCRIPTION	PART NUMBER
158	Inspiratory Valve Assembly (incl. O_2 sensor mount)	4107649
	Ref: Valve w/o O_2 sensor mount (old no.)	2122810
	(new no.)	4112773
159	Plug Assembly, Oxygen Sensor	4106387
159A	Dome & Label, Insp. Valve	4108329
159B	Valve Asm	4112151
159C	Label, Inspiration	1100559
160	Expiratory Valve Assembly	2122812
160A	Dome	2109230
161	Gasket, Valve Dome (Both Valves)	2109231
162	Disk (Both Valves)	2123249
162A	Label, Expiration	1100565
163	Gasket, Valve Mount	1101690
164	Spiromed Sensor	4106362
165	Gasket, Canister Top	4105848
166	Screen, Canister	1100022
167	Canister Assembly (2x)	4105851
168	Rod, Left	1101356
169	Clip, E-Ring (2x)	1100097
170	Spring (2x)	4110975-010
171	Bottom Sub-Assembly	4108358
172	Nut, ⅜-16 SS (4x)	HW50010
173	Cam Bar (2x)	1101018
174	Cam Assembly	1101015
175	Dowel Pin	1101017
176	Hose Assembly, Fresh Gas	4108577
177	Dust Cap	4106874
178	O-Ring	4102940
179	Rod, Right	1101355
179A	Quick Disconnect Fitting (Breathing Pressure)	4108139
180	PEEP Bypass and Valve Assembly	4111527
	Magnet assembly	4114419
	O-ring, #126 (neoprene)	4111878
	Knob	4113558
180A	Gauge Assembly, Breathing Pressure	
	(Includes Mounting Ring and O-Ring)	4105853
	Later design gauge assembly with additional scale in hPa	4115275
180B	O-Ring, #117, Silicone (2x)	4105766
	Breathing press hose asm (quick disc. ftg on each end)	4109368
	Breathing press hose asm (quick disc. ftg one end, Luer fitting other end)	4108528
	O_2 Sensor: Complete Assembly, including capsule	4110374
	Sensor Capsule: old number:. . . . 6803290	new number: 6850645
	Housing Assembly	4106363
	Adapter (cover)	4106385
	O-ring, #025 (viton)	4105791
	O-ring, #016 (viton) (2x)	4106388


181
182
184
185
183
197
196
187
192
195
202
198
188
201
186
190
191
193
200
203
189
199
208
194
195 A
195 B
207
206
192 A
205
204
ABSORBER ASSEMBLY FLANGE
SV30915

ITEM	DESCRIPTION	PART NUMBER
181	Valve, Man/Auto Selector	4102698
182	APL Valve	4104839
183	Fiber Washer	Supplied with APL Valve
184	Screw, Selector Valve Mounting 8-32 x 7/16 in. Skt Hd Cap (3x)	HW01013
185	Lock Washer, Selector Valve Mounting, #8 int-t (3x)	HW67000
186	O-Ring, Neoprene	4102941
187	Screw, Adapter Flange Mounting 8-32 x ½ in. (4x)	HW01014
188	Adapter Flange	4102694
189	O-Ring, Silicone	4105767
190	Valve Housing	4102734
191	Valve Channel	4102692
192	Spring	4110975 P-005
192A	Switch Assembly	4102700
193	Dowel Pin, 0.187 x ¾ in.	HW76002
194	Dowel Pin, 0.250 x ⅝ in.	HW76003
195	Valve Switch	4102690
195A	Label, Bag/Auto	4102699
195B	Label, Dot NAD	1101098
196	Stem	1101011
197	Ball	4101848
198	Ball Bearing (2x)	11011637
199	Cover	4103118
200	Valve Switch Block	4102691
201	Screw, Adjustment, ¼-28 x ¼ in. (2x)	HW04014
202	Screw, Valve Switch Block Mounting, Upper, 8-32 x ¼ in. (2x)	HW01019
203	Screw, Valve Switch Block Mounting, Lower, 8-32 x ½ in. (2x)	HW01020
204	Bag Connector	4102894
205	Swivel Bag Mount Assembly	1101334
206	Screw, Bag Mount, 8-32 x ⅜ in. (4x)	HW02015
207	O-Ring, Silicon	4105868
208	Glide Ring, Teflon	1101335

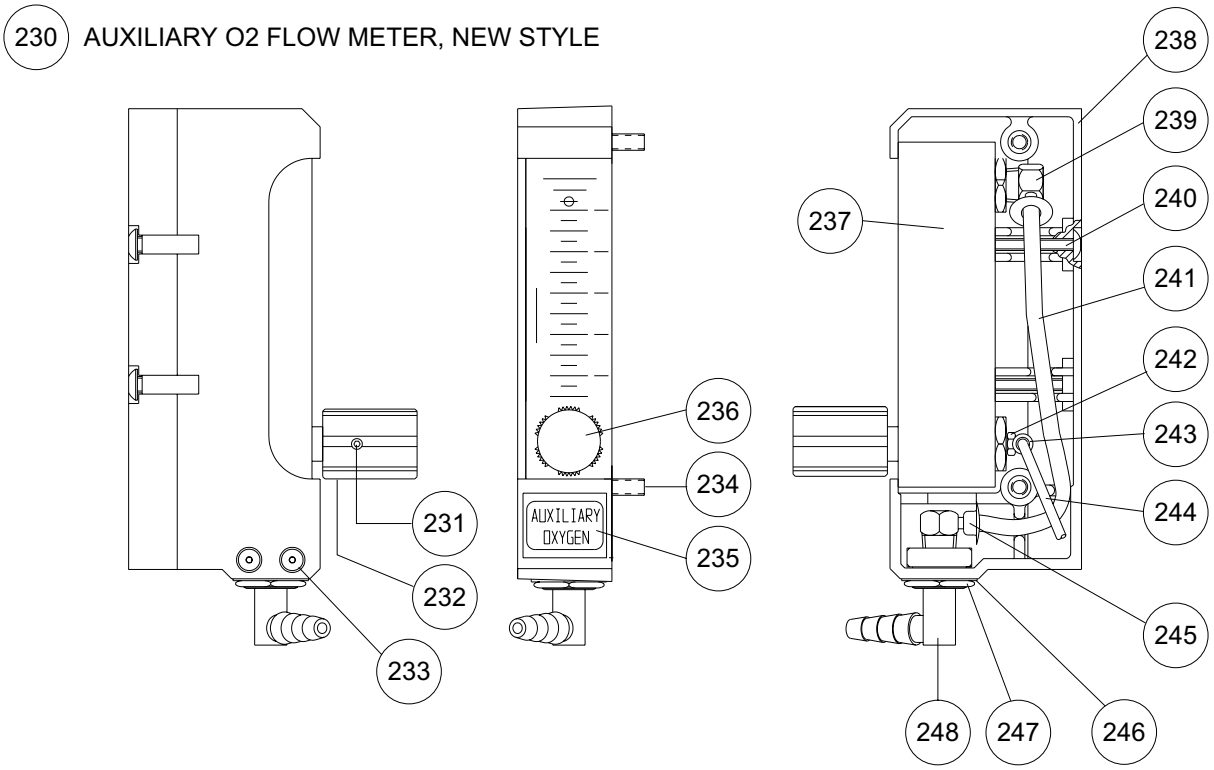
	SpO_2 Sensor	4108983

SPARE AND REPLACEMENT PARTS (continued) NM3

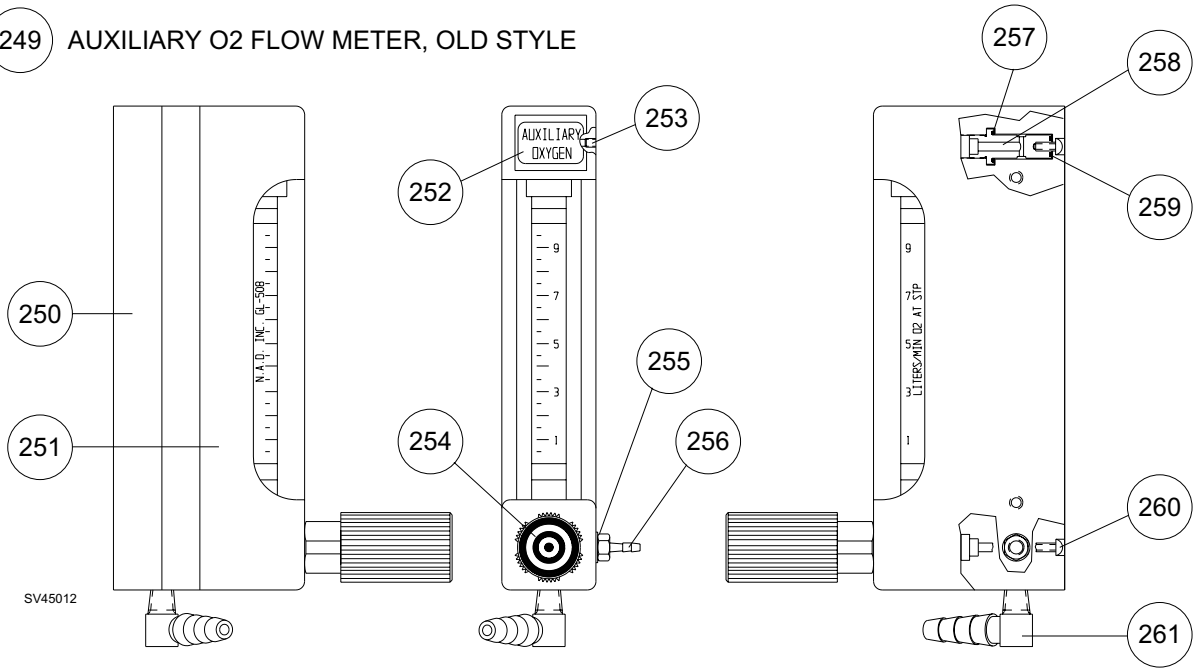


ITEM	DESCRIPTION	PART NUMBER
209	Valve, Man/Auto Selector (later design)	4112217-001
210	APL Valve	4104839
211	Fiber Washer	(Supplied with APL Valve)
212	Screw, Selector Valve Mounting, 8-32 x 7/16 in. Skt Hd Cap (3x)	HW01013
213	Lock Washer, Selector Valve Mounting, #8 int-t (3x)	HW67000
214	O-Ring, Neoprene	4102941
215	Label, "Scavenger Hose"	4104806
216	Screw, 5/16-18 x 3¾ in. Rd Hd	HW06023
217	Spacer	4110792-070
218	Screw, 8-32 x 7/16 in. Skt Hd Cap (3x)	HW01013
219	Lock Washer, #8 split (3x)	HW65011
220	Connector Assembly, 22mm	4106744
221	Label, "Ventilator Hose"	1100563
222	O-Ring, #117 Silicone	4105766
223	Spacer	4110792-071
224	O-Ring, #120 EPDM	4112629-001
225	Nut, 5/16-18 Hexseal	4112613-001
226	Hole Plug, 3/16 in. dia.	4111663-001
227	Bag Connector	4102894
228	Label, "Breathing Bag"	1100561
229	Bag Mount Assembly	4112622-001
	SpO_2 Sensor	4108983

230 AUXILIARY O2 FLOW METER, NEW STYLE



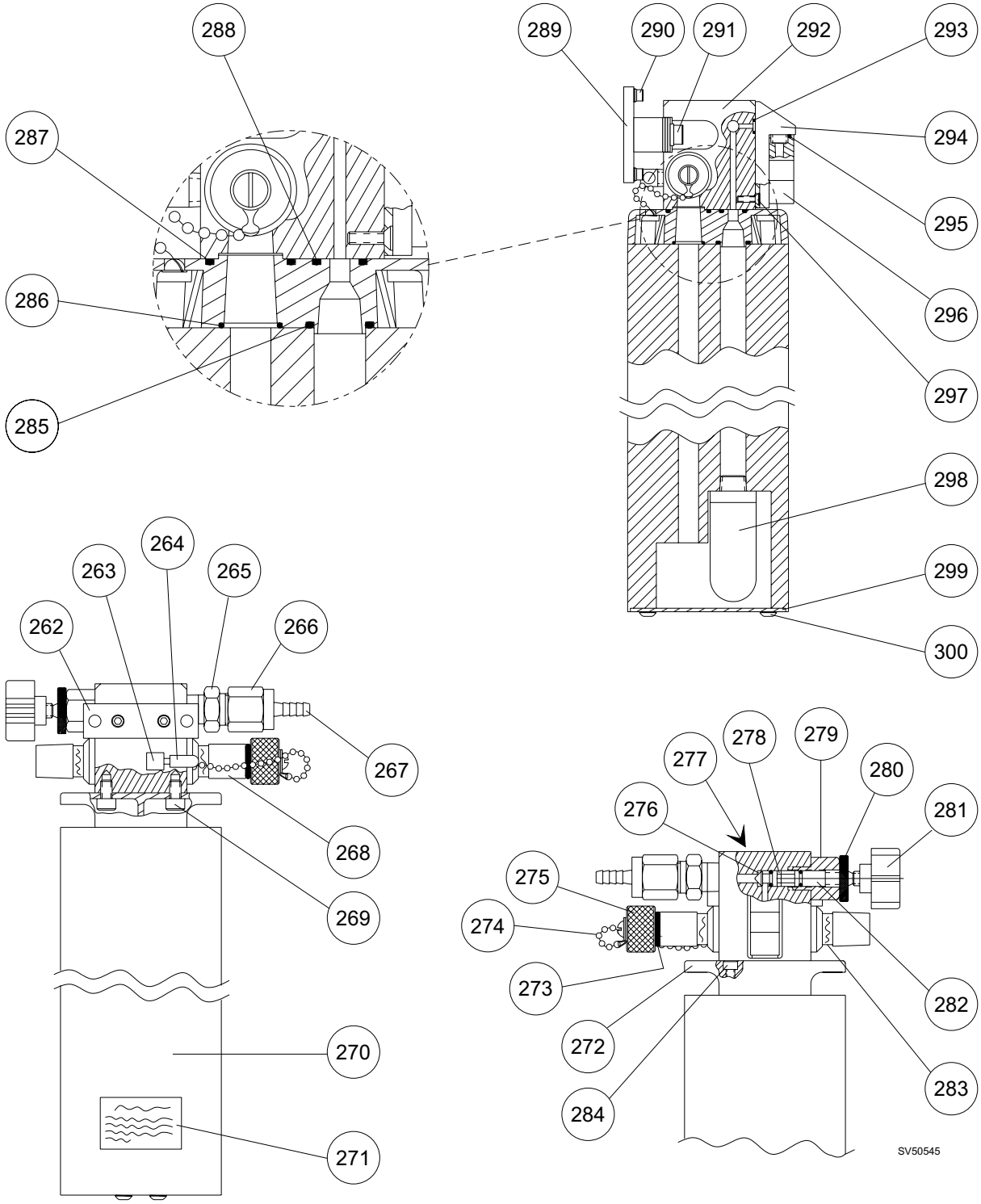
249 AUXILIARY O2 FLOW METER, OLD STYLE



ITEM	DESCRIPTION	PART NUMBER
230	Auxiliary O_2 Flow Meter Assembly, new style	4109310
231	Set Screw, cup point, 6-32 x ¼ in.	HW04003
232	Knob	4111442
233	Screw, 6-32 x ¼ in., btn hd (2x)	HW09004
234	Set Screw, cup point, 10-32 x ⅞ (2x) (used as mtg stud)	HW04011
235	Label, AUXILIARY OXYGEN	4109381
236	Label, ⅝ w/dot and green & white rings	4109373
237	Flowmeter (incl. tube & valve)	4111460
238	Housing	4111053
239	Ell, ⅛ hose x ⅛ MPT (2x)	4111445
240	Screw, 10-32 x 1 1/16 in. btn hd (2x)	HW09043
241	Hose, 0.13 in. I.D., 4.63 in.	ML08007
242	Ell, 1/16 hose x 8-32M	4110173
243	Press-on hose clamp	4104161
244	Hose, 0.075 in. I.D., 7 in.	ML08003
245	Press-on hose clamp (2x)	4111495
	Label, O_2 tubing (2x) (not shown)	4109871
246	Lock washer, ⅝ int-t	4111444
247	Panel nut, ⅝-32	4111443
248	Bulkhead & hose barb asm	4111440

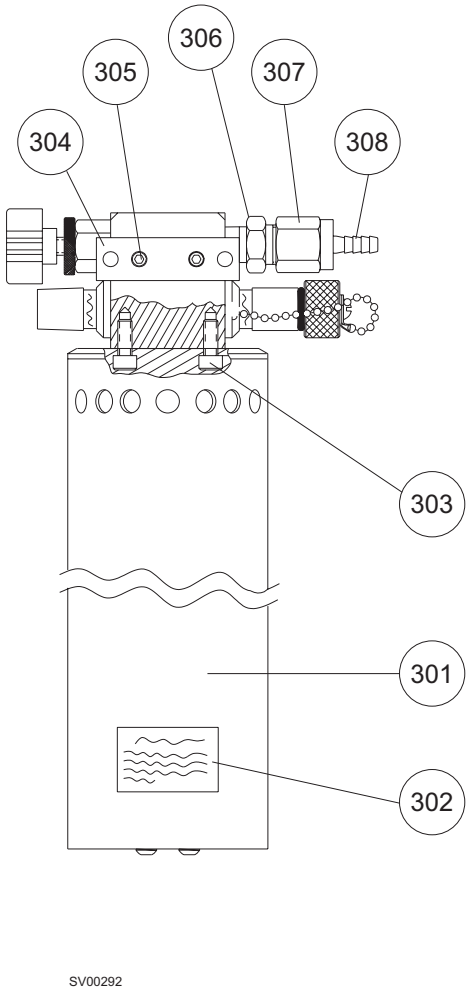
249	Auxiliary O_2 Flow Meter Assembly, old style	4109391
250	Mounting block	4109389
251	Flowmeter (incl. knob, tube & valve)	4109384
252	Label, AUXILIARY OXYGEN	4109381
253	Set screw, cup point, 10-32 x ¼ in.	HW04009
254	Label, ⅝ w/dot and green & white rings	4109373
255	Washer	4102165
256	Hose barb ftg, 10-32 x 1/16 hose	4103445
257	O-ring, #12 (neoprene) (2x)	1101523
258	Adapter (2x)	4109331
259	O-ring, #009 (viton) (4x)	4105962
260	Screw, 10-32 x 5/16 in. btn hd (2x)	HW09016
261	Ell, 3/16 hose	4109387

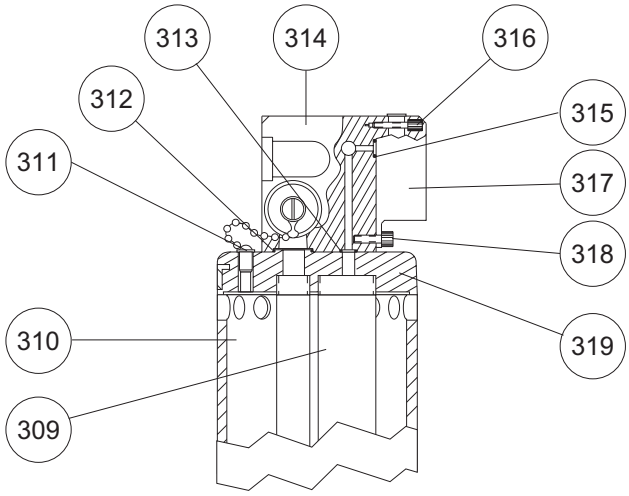
SPARE AND REPLACEMENT PARTS (continued) **NM3**

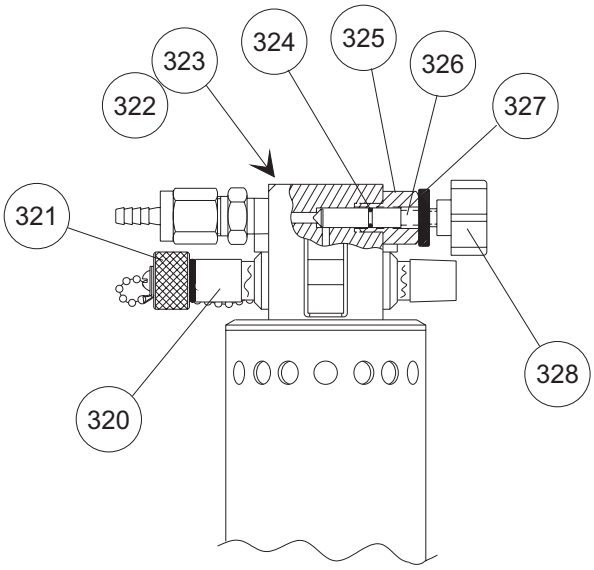


ITEM	DESCRIPTION	PART NUMBER
	Open Reservoir Scavenger Assembly	4107624
262	Mounting Bracket	4109314
263	Elbow, ⅛ M x ¼ in. hose	4106881
264	Cap, Vinyl	4110045
265	Body, DISS VAC x ¼ MPT	4103669
266	Nut, DISS VAC	4103122
267	Hose Barb Nipple	4103123
268	19 mm Connector (2x)	4109315
269	Screw, ¼-20 x ⅜ in. skt hd (2x)	HW01033
270	Reservoir	4110982
271	Label, CAUTION	4104294
272	Reservoir Top	4110979
273	O-ring #112 (neoprene)	4102141
274	Chain, 8¼ lg	4112495-005
275	Plug	4102140
276	O-ring #008 (neoprene)	4102022
277	Label, ACTIVATE HOSPITAL VACUUM	4109305
278	Retaining Ring	4110997
279	Nut, Valve Stem Retainer	4109316
280	Lock Nut, ⅜-24	4112137
281	Wing Nut	4105699
282	Spindle	4112138
283	Label, SCAVENGER HOSE (2x)	4104806
284	Screw, 10-32 x ¾ in. skt hd (4x)	HW01028
285	O-ring #019 (neoprene)	4106458
286	O-ring #015 (neoprene)	4104602
287	O-ring #019 (neoprene)	4106458
288	O-ring #013 (neoprene)	4102234
289	Bracket Assembly	4106231
290	Screw, 10-32 x ½ in. skt hd (2x)	HW01025
	Lock Washer, #10 split (2x)	HW65003
	Flat Washer, #10 (2x)	HW66003
291	Screw, ¼-20 x ½ in. skt hd (2x)	HW01034
	Lock Washer, ¼ int-t (2x)	HW67005
292	Block	4111002
293	O-ring, #008 (neoprene)	4102022
294	Flowmeter Housing	4110980
295	O-ring, #012 (neoprene)	1101523
296	Flowmeter	4112289
297	Screw, 6-32 x ⅜ in. flat hd (2x)	HW05006
298	Silencer	4110999
299	Reservoir Cap	4111000
300	Screw, 10-32 x ⅜ in. btn hd (4x)	HW09005

SPARE AND REPLACEMENT PARTS (continued) NM3

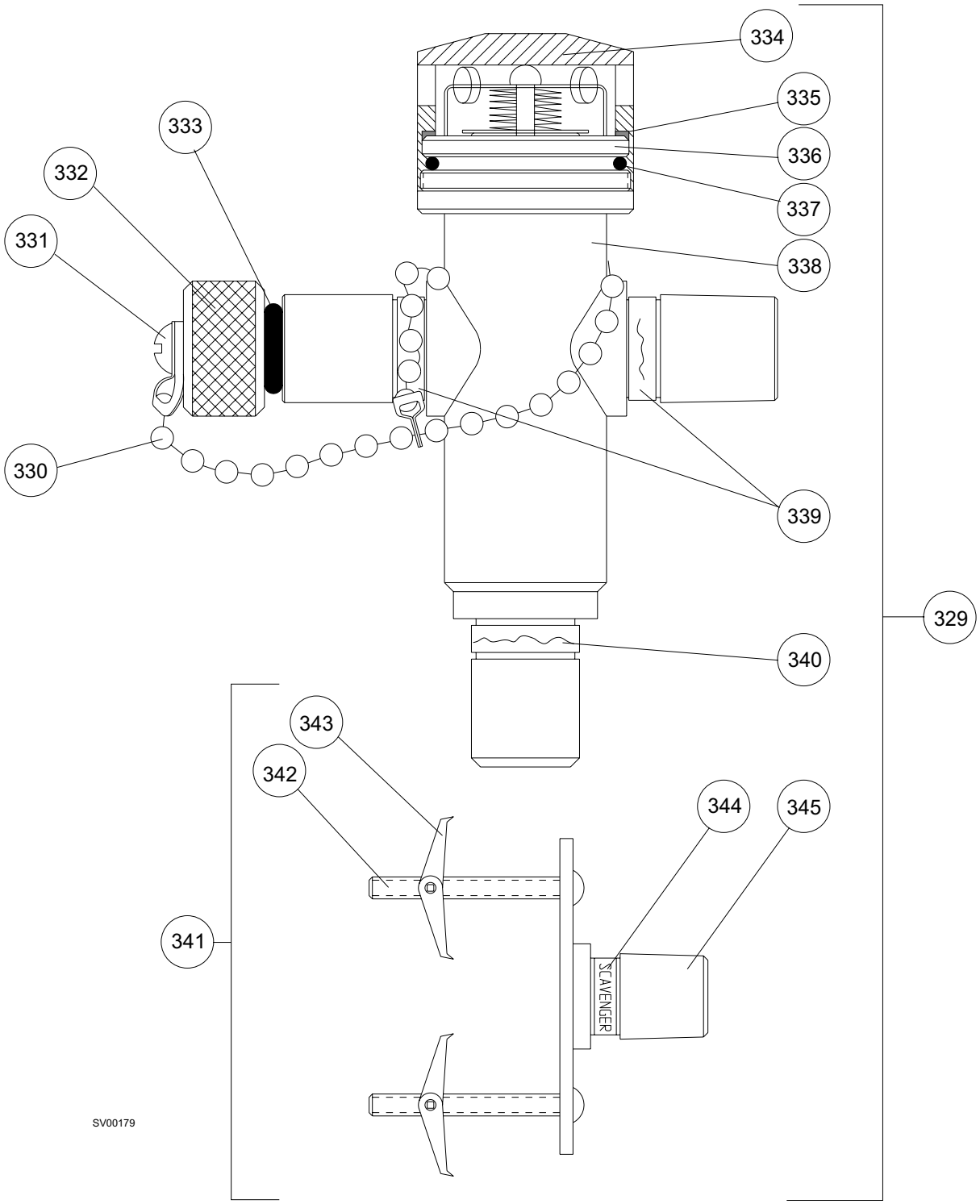






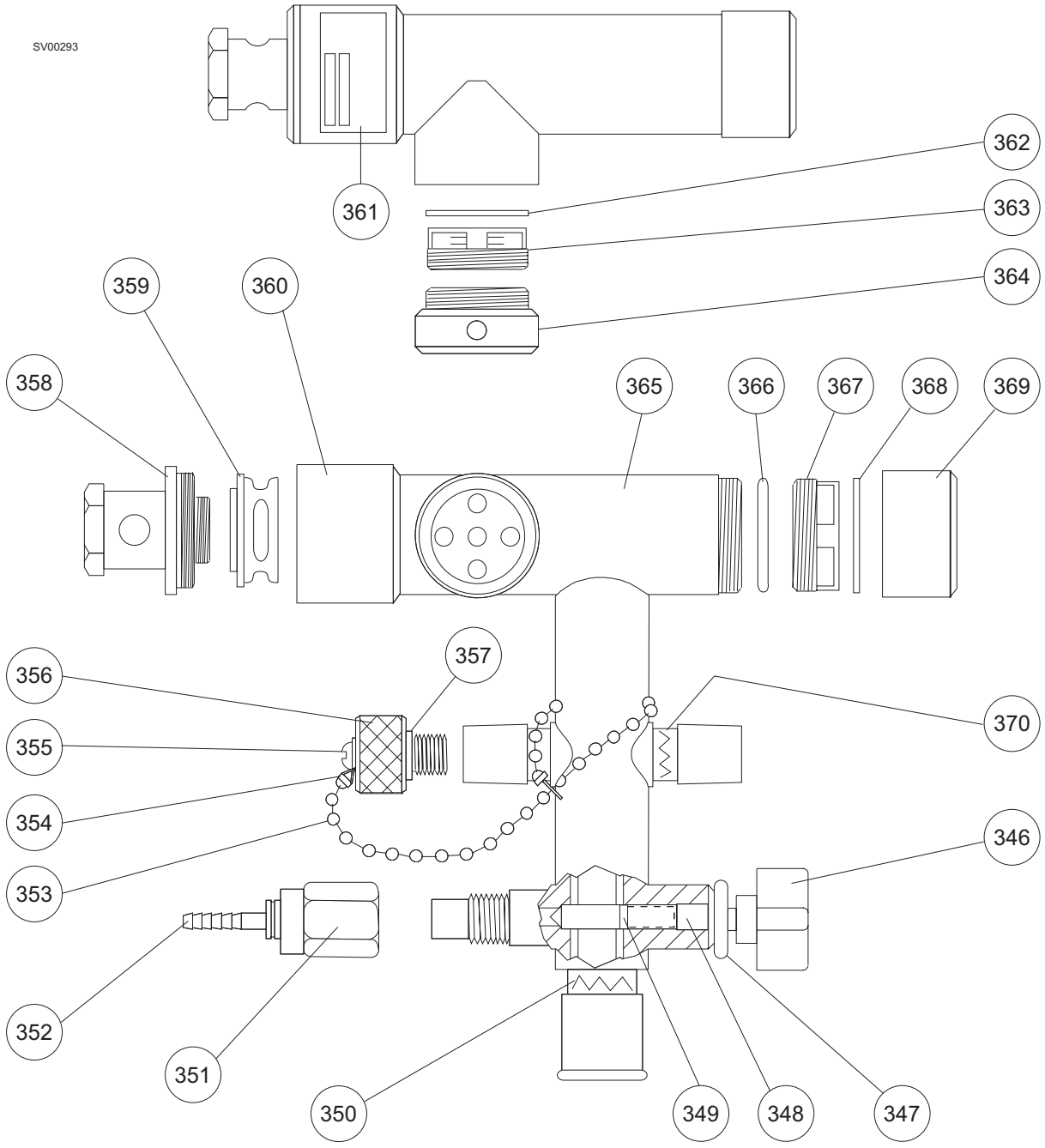
ITEM	DESCRIPTION	PART NUMBER
	Open Reservoir Scavenger Assembly, old style	4109321
301	Reservoir Assembly	4109320
302	Label, CAUTION...	4104294
303	Screw, cap skt hd, ¼-20 x ¾ in. (2x)	HW01036
304	Mounting Bracket	4109314
305	Screw, flat hd, 8-32 x ¾ in. (2x)	HW03026
306	DISS body x ¼ MPT	4103669
307	DISS nut	4103122
308	Hose barb	4103123
309	Tube, 1 in. dia	4109312
310	Tube, ¾ in. dia	4109311
311	Screw, btn hd, 10-32 x ⅜ in.	HW09005
312	O-ring, #016 neoprene	4109322
313	O-ring, #010 neoprene	4101872
314	Block	4109309
315	O-ring, #008 neoprene	4102022
316	Screw, cap skt hd, 6-32 x ⅝ in.	HW01067
317	Flowmeter	4109306
318	Screw, cap skt hd, 6-32 x ¼ in.	HW01007
319	Top, Scavenger Reservoir	4109307
320	Connector, 19 mm (2x)	4109315
321	Plug assembly	4102098
322	Label, S/N	4109589
323	Label, ACTIVATE HOSPITAL VACUUM	4109305
324	O-ring, #008 neoprene	4102022
325	Nut, valve stem retainer	4109316
326	Spindle	4102068
327	Lock nut, ⅜-24	4105990
328	Wing nut	4105699

SPARE AND REPLACEMENT PARTS (continued) **NM3**



ITEM	DESCRIPTION	PART NUMBER
329	Scavenger, A/C	4106161
330	Chain assembly, 8¼ in.	4112495-006
331	Screw, round hd, 10-32 x ½ in.	HW06007
332	Plug	4102140
333	O-ring, #112 neoprene	4102141
334	Dust cover	1101527
335	Spacer	4110792-007
336	Valve 'A' 5 cm H_2O	2207032
337	O-ring, #027 neoprene	4101871
338	Body, solder assembly	4102105
339	Label, SCAVENGER HOSE (2x)	4104806
340	Label, EXHAUST	4106878
341	Vent Grill Adapter (for 19 mm hose)	1101312
342	Screw, round hd, 10-24 x 3 in. (2x)	HW06012
343	Toggle nut (2x)	4101862
344	Label, SCAVENGER HOSE	4104806
345	Adapter assembly, 19 mm	1101609
	Hose Barb Adapter	4108114

SPARE AND REPLACEMENT PARTS (continued) NM3



ITEM	DESCRIPTION	PART NUMBER
	Suction Scavenger	4102088
346	Wing nut	4105699
347	Lock nut	4105990
348	Spindle	4102068
349	O-ring, #008 neoprene	4102022
350	Label, RESERVOIR BAG	4106879
351	DISS nut	4103122
352	Hose barb	4103123
353	Bead Chain, 8¼ in.	4103940
354	Chain coupling (2x)	4101868
355	Screw, round hd, 10-32 x ½ in.	HW06007
356	Plug	4102140
357	O-ring, #112 neoprene	4102141
358	Cap assembly	4104659
359	'A' Valve, 1.8 cm H_2O	2116219
360	Housing assembly	4104755
361	Label, S/N	4106255
362	Seal, 'A' valve	4106321
363	'A' Valve, 0.5 cm H_2O	7264277
364	Dust cap	4102036
365	Tube assembly	4102030
366	O-ring, #215 neoprene	4102038
367	'A' Valve, 5 cm H_2O	2207032
368	Spacer	4110792-007
369	Dust cap	4102035
370	Label, SCAVENGER HOSE (2x)	4104806

RETURN TO THIS MANUAL'S TABLE OF CONTENTS
RETURN TO CD-ROM TABLE OF CONTENTS

Narkomed 3 Service Manual

Rev. V summary of changes

Page	Description
6-1 thru 6-62	Entire section revised to reflect PMC nomenclature

RETURN TO THIS MANUAL'S TABLE OF CONTENTS
RETURN TO CD-ROM TABLE OF CONTENTS

DrägerService®

DrägerService is a division of
Draeger Medical, Inc.
3122 Commerce Drive
Telford, PA 18969
Tel: (215) 721-5402
(800) 543-5047
Fax: (215) 721-5784
Web: www.draegermedical.com
Printed in the U.S.A.